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A REVISION OF THE MELITAEINE GENUS *CHLOSYNE* AND ALLIED SPECIES (LEPIDOPTERA: NYMPHALINAE)

By L. G. Higgins

(*Gracious Pond Farm, Chobham, Surrey*)

Manuscript received 12th February, 1960

(Read 4th May, 1960)

With 134 Text-figures

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Preliminary Note

This study has been made during a rearrangement of material at the British Museum (Natural History), London. The principal objective has been to define specific units whenever possible, and to ensure correct application of all valid names in that large section of American species in which the male genitalia show a simple tegumen. It is appropriate that this work should be done in London where the collections include the holotypes of the numerous species and forms described by Hewitson, Westwood, Butler and others, and the splendid material from Central America and South America received with the Godman-Salvin and Rothschild collections. Additional important material from Central America is contained in the Hall collection, now at Hove, Sussex, and easily available for reference, and I have been able to examine and study the extensive collection from North America in the American Museum of Natural History, New York. Even with these opportunities the differentiation of species is not always easy, and in some cases I have not found it possible. In some groups the extent of local variation may be quite bewildering, and in the large genus *Chlosyne* the genitalia in many cases fail to show clear-cut specific characters. In all cases locality data quoted without qualification are taken from specimens in the Museum collection. When I have included data from other collections or from published accounts, the place of origin is always recorded. It has nearly always been possible to check specific determinations by examination of male and female genitalia. The line drawings of these and of other anatomical features have been made with the *camera lucida* and reduced to a suitable size, The degree of reduction varies because it has been necessary to adjust the size of figure for a large species, such as *C. hippodrome* Geyer, and such minute organs as appear, for example, in the genus *Antillea* Higgins.

Abbreviations

In order to avoid unnecessary repetition, the following abbreviations are employed throughout this paper:

Am. Mus. N.H.	American Museum of Natural History, 75th Street, New York.
B.C.A.	*Biologia Centrali-Americana. Insecta, Rhopalocera*, Parts 1, 2. By F. duCane Godman and O. Salvin. 1879–1901.
B.M. (N.H.)	British Museum (Natural History), Cromwell Road, London, S.W.7.
Brown (1957)	*Colorado Butterflies*. By F. Martin Brown. Denver, 1957.
Comstock	*Butterflies of California*. By J. A. Comstock. Los Angeles, 1927.
Forbes	The genus *Phyciodes*. By W. T. M. Forbes. (*Entomologia Americana* **24** : 139–206. 1945).
Hall	Revision of the genus *Phyciodes*. By A. Hall. (*Bulletin of the Hill Museum*. Vols. 2, 3, 4. 1928–30).
Holland	*The Butterfly Book. Ed.* 1, 1902 ; *Ed.* 2, 1947. By W. J. Holland. New York.
Klots (1951)	*Field Guide to the Butterflies*. By Professor A. B. Klots. Boston, 1951.
Oberthur, Lép. Comp.	*Lépidoptérologie Comparée* **9** (1). By C. Oberthur. Rennes, 1913.
Scudder	*Butterflies of the Eastern United States and Canada*. By S. Scudder. Cambridge, Mass., 1889.
Seitz	*Macrolepidoptera of the World*. Vol. 5, 1913 (Dec.)—March 1914.
Wright	*Butterflies of the West Coast*. By W. G. Wright. San Bernadino, 1905.

Every effort has been made to trace original series and type specimens, and in this task I have had much assistance from several entomologists in North America. I am especially grateful to Dr. F. H. Rindge and Professor A. B. Klots for the opportunity to examine the collections in the American Museum of Natural History. Many notes and records of existing " type " specimens have been most kindly provided by Drs. R. L. Wenzel and J. R. Millar (Chicago), Dr. Harry Clench (Pittsburgh), Dr. Harold Grant (Philadelphia), Dr. W. T. M. Forbes (Cambridge, Mass.), Dr. Walther Förster (Munich) and Dr. H. J. Hannemann (Berlin). Other information has been supplied by Professor J. W. Tilden and Colonel F. Martin Brown, while Mr. Cyril F. dos Passos has provided me with several references to original descriptions that I had been unable to trace.

It is my pleasant duty now to acknowledge all the help that I have received, including unrestricted access to the collection at the British Museum (Natural History), and in particular the encouragement of Mr. N. D. Riley, whose advice upon difficult points has been always available.

I. Introduction

The Melitaeinae are well represented in America, with about 130 species including the *Euphydryas* series. The pattern of distribution differs greatly from that which exists in Europe and Asia, where the species are strictly Palaearctic and found only in temperate, alpine and sub-arctic climates. Of the total number of American species, perhaps 20 may be termed Nearctic elements. In temperate South America the subfamily is scarcely represented, and the remaining species, to the number of 100 or more, live in Central America and in the northern lands of South America, with a marked concentration of species from Mexico to Colombia and Venezuela. In this

area especially the systematic picture is unexpectedly complicated, and difficulties appear which are not met with, or at least are less obvious, in the related Palaearctic forms. An extensive range of variation, largely attributable to ecological modifications, occurs on both sides of the Atlantic, and commonly shows the graduated series of forms which make a recognisable cline. On the other hand, in certain American Melitaeine species, changes in facies appear that fall outside the normal cline and are difficult to interpret. In Europe specific units of the Rhopalocera generally are stable and most species of butterflies can be defined by precise characters of wing-marking and anatomy, but in some of the American forms now referred to, it may be hard to define specific limitations. Indeed, in certain cases it is doubtful whether specific status has been reached or whether the differences observed are simply the effect of a small genetic change in a particularly plastic population. It is unfortunate that, in these butterflies, the characters of the genitalia are much less helpful than in the European species. These taxonomic difficulties are particularly troublesome in *Euphydryas* and *Chlosyne*. It seems that these variable butterflies should be regarded as unstable populations in process of active development and evolution, so that the separation into conventional species and sub-species is, to some extent, a matter of individual opinion. In the case of *Euphydryas* it may be suggested that the vast extent of Quaternary glaciation in North-West America in the relatively recent past, is now being followed by repopulation from the south, which is still in progress and is in some way responsible for the conditions that exist today.

In recent years the Melitaeine butterflies of America, excluding *Euphydryas*, have been studied by Hall (1928–30) and by Forbes (1945). The latter author has indicated a basic separation of the majority of species into two, or possibly three, large sections, and it is convenient to consider the series in this way. On the one hand, there are the numerous species of *Phyciodes* and their allies, in which the male genitalia show a complicated tegumen, with the clasp tapering posteriorly to a single process and with nervure 6 of the fore wings arising with, or close to, the stalk of 7–10. This large assembly of over 100 species does not show any feature that suggests relationship with any Palaearctic group. Another small but interesting and isolated section comprises the genus *Gnathotriche* Felder, restricted to the Andes in the north-western region of South America. A third major section, including *Chlosyne*, with over 30 species and numerous in individuals and mimetic forms, again presents an entirely different anatomy. The male genitalia show a wide, simple tegumen, the clasper bears an additional tooth at the posterior inferior angle, and on the fore wing the upper disco-cellular nervure is usually developed. These features recall the Palaearctic *Mellicta*, and the relationship is confirmed by the characteristic female genitalia, in which a long, double bacillus appears. It is this third section which is considered in the present paper. On close examination the series is seen to be complex, with species and small groups showing atypical characters, diverging more widely from one another than any that occur among the Palaearctic forms. For this reason, and in spite of the relatively small number of species concerned, nine genera are required to present a satisfactory picture of specific affinities. While there is certainly evidence of relationship with Palaearctic species, the differences are generally too marked to allow inclusion in the well-known Palaearctic genera. In two cases only does a close generic affinity appear. The species *minuta* W. H. Edwards shows such a close approach to the European *cinxia* L. in habitus and wing pattern, that I think it is possible to include this butterfly in the genus *Melitaea* Fabricius in spite of quite aberrant male genitalia. The second case referred to is *perezi* Herrich-Schaeffer from Cuba and the closely related *pantoni* Kaye and *tulita* Dewitz from neighbouring islands in the Greater Antilles. These three butterflies have an unusual wing pattern, but in the form of the palpi and of the male genitalia they recall the *fergana* group of *Melitaea*, now restricted to the high mountains of Central Asia. In this case the general appearance of the insects is so unusual that they have been placed in a

distinct genus (*Atlantea*), but the relationship to the eastern forms cannot be doubted. In view of the anatomical evidence of affinity with various Palaearctic groups which is found in the butterflies of this third section, it is noteworthy that the species are found principally in the south-west of North America and in Central America, where at least 22 species occur. On the other hand only 6, or possibly 7, species, all of the genus *Chlosyne*, have been recorded from any part of the Continent north of the 45th parallel of latitude, where in the Old World the maximum concentration of species and individuals appears.

Finally, I think a short account of the genitalia may be helpful. In the male a special feature appears in the juxta (ringwall), which is developed as a broad ventral plate occupying the space between the clasps, in a fashion that seems to be characteristic of the Melitaeinae. It is present in all genera and usually terminates posteriorly in a bold edge, often with a central crest (*Euphydryas*), but in *Chlosyne* the posterior border is weak—no more than a thin membrane. The female genitalia usually show a well-defined sterigma (genital plate) with a pair of divergent rods (bacilli), which arise near the ostium bursae and appear to support the ductus. The anterior vaginal plate may be deeply sculptured at each lateral angle to form the small auricles which are occasionally of value in specific determination.

The full terminology employed is indicated in the figure of the genitalia of *Chlosyne acastus* W. H. Edwards (fig. 58), where the different parts are clearly shown and named.

II. Systematic Catalogue of Species and Forms Considered

1. **Melitaea** Fabricius
   - (1) *M. minuta* W. H. Edwards
     - (*a*) form *minuta* W. H. Edwards
     - (*b*) form *pola* Boisduval
     - (*c*) form *nympha* W. H. Edwards
     - (*d*) named occasional forms

2. **Atlantea** Higgins
   - (1) *A. perezi* (Herrich-Schaeffer)
   - (2) *A. tulita* (Dewitz)
   - (3) *A. pantoni* (Kaye)

3. **Chlosyne** Butler
   - (*A*) The **lacinia** group
   - (1) *C. janais* (Drury)
     - (*a*) form *marianna* Rober
     - (*b*) form *gloriosa* Bauer
     - (*c*) form *irrubescens* Hall
   - (2) *C. rosita* Hall
   - (3) *C. hippodrome* (Geyer)
     - (*a*) form *fabricii* **nom. nov.**
   - (4) *C. gaudealis* (Bates)
     - (*a*) form *laeta* Rober
   - (5) *C. narva* (Fabricius)
     - (*a*) form *bonplandi* (Latreille)
   - (6) *C. ehrenbergi* (Geyer)

(7) *C. lacinia* (Geyer)
  (*a*) *lacinia lacinia* (Geyer)
  (*b*) form *indigens* Hall
  (*c*) form *montana* Hall
  (*d*) *lacinia crocale* (W. H. Edwards)
  (*e*) *lacinia quehtala* (Reakirt)
  (*f*) form *adelina* (Staudinger)
  (*g*) form *paupera* (C. and R. Felder)
  (*h*) *lacinia saundersi* (Doubleday)
  (*i*) form *adjutrix* Scudder
  (*j*) form *californica* (Wright)
  (*k*) named occasional forms

(8) *C. melanarge* (Bates)

(9) *C. erodyle* (Bates)

(10) *C. poecile* (C. and R. Felder)
  (*a*) form *rubrigutta* Rober

(11) *C. eumeda* (Godman and Salvin)
  (*a*) form *dryope* (Godman and Salvin)

(12) *C. marina* (Geyer)
  (*a*) form *melitaeoides* (C. and R. Felder)

(13) *C. endeis* (Godman and Salvin)
  (*a*) form *pardelina* **forma nov.**

(14) *C. definita* (Aaron)

(*B*) The **palla** group

(15) *C. palla* (Boisduval)
  (*a*) form *calydon* (Edwards) (Holland)
  (*b*) form *whitneyi* auct.
  (*c*) named occasional forms

(16) *C. acastus* (W. H. Edwards)
  (*a*) *acastus neumoegeni* (Skinner)

(17) *C. damoetas* (Skinner)

(18) *C. gabbii* (Behr)
  (*a*) *gabbii flavula* (Barnes and McDunnough)
  (*b*) other described forms

(19) *C. sterope* (W. H. Edwards) forma incognita

(20) *C. malcolmi* (Comstock)

(21) *C. hoffmanni* (Behr)
  (*a*) form *segregata* (Barnes and McDunnough)
  (*b*) named occasional forms

(*C*) The **harrisii** group

(22) *C. harrisii* (Scudder)
  (*a*) form *hanhami* (Fletcher)
  (*b*) form *liggetti* (Avinoff)

(23) *C. gorgone* (Huebner)

(24) *C. nycteis* (Doubleday)
  (*a*) form *drusius* (W. H. Edwards)
  (*b*) form *reversa* (F. H. and R. L. Chermok)
  (*c*) named occasional forms

4. **Thessalia** Scudder
   (1) *T. leanira* (C. and R. Felder)
      (*a*) form *leanira* (C. and R. Felder)
      (*b*) form *wrightii* (W. H. Edwards)
      (*c*) form *cyneas* (Godman and Salvin)
      (*d*) form *alma* (Strecker)
      (*e*) form *cynisca* (Godman and Salvin)
      (*f*) named occasional forms
   (2) *T. theona* (Ménétriés)
      (*a*) form *theona* (Ménétriés)
      (*b*) form *thekla* (W. H. Edwards)
      (*c*) form (?) *chinatiensis* (Tinkham)
      (*d*) form *perlula* (C. and R. Felder)
      (*e*) *theona ezra* (Hewitson)
      (*f*) other described form.

5. **Texola** Higgins
   (1) *T. elada* (Hewitson)
      (*a*) *elada ulrica* (W. H. Edwards)
      (*b*) *elada perse* (W. H. Edwards)
   (2) *T. anomalus* (Godman and Salvin)
   (3) *T. coracara* (Dyar)

6. **Dymasia gen. nov.**
   (1) *D. dymas* (W. H. Edwards)
      (*a*) form (?) *larunda* (Strecker)
      (*b*) other described forms

7. **Microtia** Bates
   (1) *M. elva* Bates
      (*a*) form *horni* Rebel

8. **Fulvia** Higgins
   (1) *F. fasciata* (Hoppfer)
   (2) *F. miriam* (Dognin)

9. **Antillea** Higgins
   (1) *A. pelops* (Drury)
   (2) *A. proclea* (Doubleday and Hewitson)

1. **Melitaea** Fabricius

Melitaea Fabricius, 1807, *Mag. Insektenk.* (Illiger) **6** : 284. Type-species : *Papilio cinxia* L.

This large genus, with about 40 species inhabiting Europe and Asia, is represented in America by the single species *minuta* Edwards. The insect appears in the south-western States of North America and in Mexico as an isolated form without near allies.

Wing-markings almost identical with those of the widely distributed Palearctic butterfly *Melitaea cinxia* L. ; *male genitalia* show divergent features (described below). Structurally the relationship to *cinxia* seems less close than the wing markings suggest, and in several features there is a closer approach to *M. trivia* Schiffermueller, a Palaearctic species with very extensive distribution.

(1) *Melitaea minuta* W. H. Edwards

Neuration : in fore wing (fig. 1) upper disco-cellular nervure is developed, middle disco-cellular concave basally ; cell closed by lower disco-cellular nervure which is well developed and tubular almost to its junction with middle disco-cellular ; in hind wing (fig. 2) lower disco-cellular nervure present and closes lower half of cell (This unusual feature also appears in the Palaearctic species *trivia* Schiffermueller and *yuenty* Oberthur.)

Male genitalia (fig. 3) : tegumen conical with well-developed subuncal processes ; clasp, in lateral view (fig. 4), wide with a strong process at posterior inferior angle (some forms of *trivia* show a very similar process (*cf.* Higgins, 1956, *Z. Wien. ent. Ver.* **41** : 12)) ; penis (fig. 5) very long with a slender pointed apex and ample ostium-folds.

Female genitalia (fig. 6) : sterigma simple, ostium exposed ; bacillus shows two rather weak limbs, fused at their base into a single wide stem, agreeing with the formation in the section of the genus to which *cinxia* belongs.

Palpi (fig. 7) : definitely ascending, terminal segment short and wide, about one-quarter as long as middle segment and thickly clothed with orange hairs.

Male fore leg (fig. 8) : relatively long, with a well-developed tarsal segment.

Variation.—The species shows only slight variation on a cline, the chief features of which are greater or less intensity of the orange ground colour on the upper surface and the presence or absence of dark suffusion. Three forms have been described and named, but the distinctions are indefinite and intermediate transitional specimens are common.

Biology.—Two generations occur in suitable localities in Colorado, California and Arizona, etc., and specimens dated September in B.M. (N.H.) are small but not otherwise remarkable. In high mountains, where the butterfly occurs at altitudes up to 10,000 feet, a single brood appears in June or later. The life history is described by Grace and Sperry (1932, *Bull. S. Calif. Acad. Sci.* **31** : 8). The mature larva is white, the head and legs orange, the short spines black, except a dorso-lateral row, which is orange-brown. There is a broken black dorsal line and a darker stripe above the legs. Larvae from Colorado at 8900 feet. Food plant *Penstemon alpinus*.

(*a*) form *minuta* W. H. Edwards

Melitaea minuta W. H. Edwards, 1861, *Proc. Acad. nat. Sci. Philad.* **1861** : 161. Loc. Texas.
Type : lost ?
Melitaea approximata Strecker, 1900, *Lepidopt. Suppl.* **3** : 23. Loc. Texas.
Type : Chicago Nat. Hist. Mus.

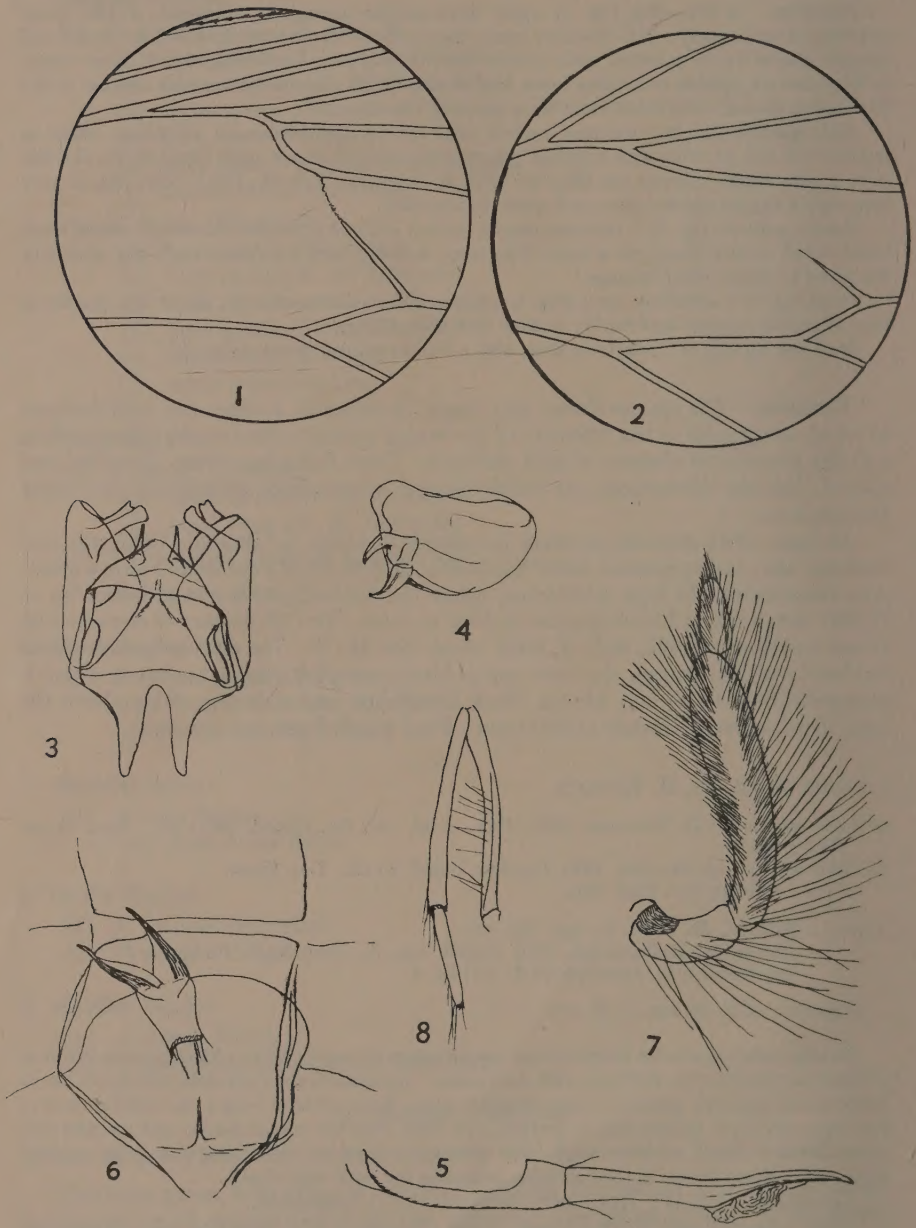
Figures : Holland, *Ed.* 2 : Pl. 58, figs. 12♂, 13♀.
Barnes and McDunnough, 1916, *Contrib. Lep. N. Amer.* **3** : Pl. 10, figs. 4, 7.
Comstock, 1918, *Lepidopterist* **2** : (11) fig. 4.

Expanse : ♂ 28–35 mm., ♀ 32 mm.

Usually rather small with bright orange ground colour on upper surface ; black pattern complete without any tendency to suffusion with dark scales ; marginal lunules not well developed ; small black points typically present in sub-marginal orange fascia of hind wing ; on under surface of fore wing the black pattern lightly marked ; on hind wing the orange fasciae and macules well developed and colour intense ; small black markings across the disc enlarged to form rounded spots. The single female in the collection resembles the male very closely.

Localities.—Texas : Kerr Co. ; Brewster Co. (1 specimen).

Note.—Barnes and McDunnough, when discussing this form (*loc. cit.*), state that they have seen it only from Kerrville, Texas, and assume that the distribution is restricted. The short series in the B.M. (N.H.) is from the same locality, and, although the form is recognisable, I cannot suggest the extent of its distribution in the State. In the absence of further information I would place it as an ecological form rather than as a sub-species. Holland's figure 13 (female) is said to show the " type ", but W. H. Edwards (1869), when describing *arachne*, stated that the type of *minuta*



Figs. 1–8.—*Melitaea*: *minuta*: (1) fore wing, neuration of disco-cellular area; (2) hind wing, neuration; (3) male genitalia, dorsal view; (4) the same, lateral view of clasp; (5) penis, lateral view; (6) female genitalia; (7) palpus, male; (8) male fore leg.

was no longer in America, meaning, presumably, that he had sent it away. If, in fact, it is lost, the present application of *minuta* must remain traditional, but it is employed in the same sense by Holland, Comstock and Barnes and McDunnough.

(*b*) form *pola* Boisduval

Melitaea pola Boisduval, 1869, *Ann. Soc. ent. Belg.* **12** : 56. Loc. Sonora, Mexico.
Melitaea arachne W. H. Edwards, 1869, *Trans. Amer. ent. Soc.* **2** : 372. Loc. Colorado.
Type (1 ♂ + 1 ♀) *:* Carnegie Mus.
Melitaea monache Comstock, 1918, *Lepidopterist* **2** : 71. Loc. California, Tulare Co.
Melitaea gilensis Holland, 1947, *Ed. 2* : 129, Pl. 58, fig. 18 (♂ holotype).
Holotype : Carnegie Mus.

Figures : Comstock, Pl. 38, figs. 11, 12, 13.
ditto, 1918, *loc. cit.* : figs. 1, 2, 3 (*monache*).
Wright, Pl. 20, fig. 194*a*, *b*.
Oberthur, *Lép. Comp.* : fig. 2188 (*pola*).
Holland, Pl. 58, fig. 11 (*monache*).
Mead, 1875, *Wheeler Survey* **5** : Pl. 36, fig. 1, 2 ♂.

Expanse : ♂ 31–35 mm., ♀ 35–40 mm.
In male markings on upper surface not heavy ; on under surface markings lighter but rather more complete than in typical *minuta* from Texas ; on hind wings the orange fasciae narrow and the black striae very small and delicate ; traces of black points may appear in the small submarginal macules. In female markings on upper surface more delicate and fore wings appear wider and more ample, giving this sex a characteristic appearance.

In Boisduval's collection *pola* was represented by a single specimen which was figured by Oberthur. No doubt this figure is an accurate representation of the specimen which must be considered the type, but I do not know if the actual specimen exists today. The illustration shows a form without colour contrast, with three small dots in the submarginal macules of the hind wing and corresponds perfectly with a long series of specimens from Colorado, although the example in question is stated to have come from Mexico. As Brown remarks (1957 : 76), similar specimens occur over a wide area, and it does not seem possible to maintain a sub-specific status for the form from Colorado. The form *monache* Comstock is best placed here. It was taken at an altitude of 8500–9000 feet on Monache Meadows, Tulare Co., California, in August. Barnes and McDunnough have pointed out that Boisduval's name *pola*, presumed date of publication early in 1869, should take precedence over *arachne*, which did not appear until the end of that year.

Localities.—Colorado : Colorado Springs, 6000 feet (June) ; Moraine Park, 8200 feet (August) ; Divide, 10,000 feet. ; Glenwood Springs (June) ; " Colorado ", Sept. 10–20 (? gen. 2) ; etc.
Arizona : Greenlea Co. (7th July).

(*c*) form *nympha* W. H. Edwards

Melitaea nympha W. H. Edwards, 1884, *Papilio* **4** : 53. Loc. Arizona.
Type : Carnegie Mus., 2 ♂.

Figures : Holland, *Ed. 2* : Pl. 58, figs. 14, 15 (transitional only).
Wright, Pl. 20, fig. 191 (transitional only).

Expanse : ♂ 31–35 mm., ♀ 35–40 mm.
Upper surface in both sexes somewhat clouded with dark scales and the black pattern more heavily marked ; against this darker background a paler postdiscal fascia, sometimes nearly white, stands out in marked contrast across both wings ; on under-surface of fore wings the black pattern well developed and the same pale fascia also present ; on hind wings the small black macules in discal areas often enlarged into rounded spots.

This form, with darkened wings and a pale discal fascia, is very striking when the characters are well-marked, but this occurs only in selected specimens. Examples in the collection from Fort Grant do not show colour contrast and differ from typical *pola* only in the heavily marked black pattern on the upper surface, while other specimens look transitional to typical *minuta*. The series from Mexico is very variable, with brilliant colour-contrast in several males, but others cannot be distinguished from the Arizona series.

Localities.—Arizona : Benson (no date) ; Fort Grant (no date) ; Huachaca Mts., August (gen. 2?).

Mexico : North Sonora ; Fort Wingate (1 ♂).

(*d*) Named occasional forms

(i) *polingi* *Melitaea minuta* male ab. *polingi* Gunder, 1926, *Ent. News* **37** : 2. A specimen much suffused with dark scales on the upper surface of the fore wing.

(ii) *gunderiae* *Melitaea arachne* ab. *gunderiae* Holland, 1947, *Butt. Book, Ed.* 2 : 128 (fig.). A male specimen with a dark fascia across the disc of the hind wings.

2. **Atlantea** Higgins

Atlantea Higgins, 1959, *Lepid. News* **12** : 162. Type-species : *Synchloe perezi* H.-S.

Fore wing (fig. 9) *:* apex produced, hind margin slightly excavated ; nervure 6 arises near stalk of 7–10 ; cell weakly closed. *Hind wing :* discoidal cell quite open. *Male genitalia* (fig. 11) *:* organ short, tegumen simple and slightly conical ; clasp (fig. 12) terminating in a single process which is curved downwards and backwards and carries a number of small teeth along its posterior border ; a massive harpe present, directed backwards ; penis (fig. 16) pointed with rather elaborate ostium folds ; suspensory ligament placed just behind centre of organ, and proximal limb slightly depressed. *Female genitalia* (fig. 13) *:* structure unusual (*perezi* only) ; in a single preparation sterigma appears wide and shallow, with a large cone from which arise two short conical processes, possibly representing the bacilli ; (it is unlike the structure of any other species that I have examined). *Palpi* (fig. 10) *:* ascending and densely clothed with orange hair-scales which rise to a crest on dorsum of second segment ; terminal segment short, about one-fifth length of second segment. *Antennae :* club pyriform and rather wide. *Male fore leg* very hairy, with a long tarsus.

These insects are often associated with *Chlosyne narva* and *C. gaudealis*, which they resemble in the shape of the fore wings. The anatomical features do not confirm this relationship, but suggest instead an approach to some species of Palaearctic *Melitaea* that now inhabit Central Asia.

These interesting butterflies show some unusual features. The three species form a compact and isolated group in the Greater Antilles and the well-marked specific characters disclosed by the male genitalia are rather unexpected, in view of the close similarity of all three in external colour and pattern. The structural approach to *Melitaea* of the *didyma* group is striking and it does not appear that any close relatives exist in Central or in North America. The flight places are extremely localized, examples of all species are rare in collections and little or nothing is known of their habits.

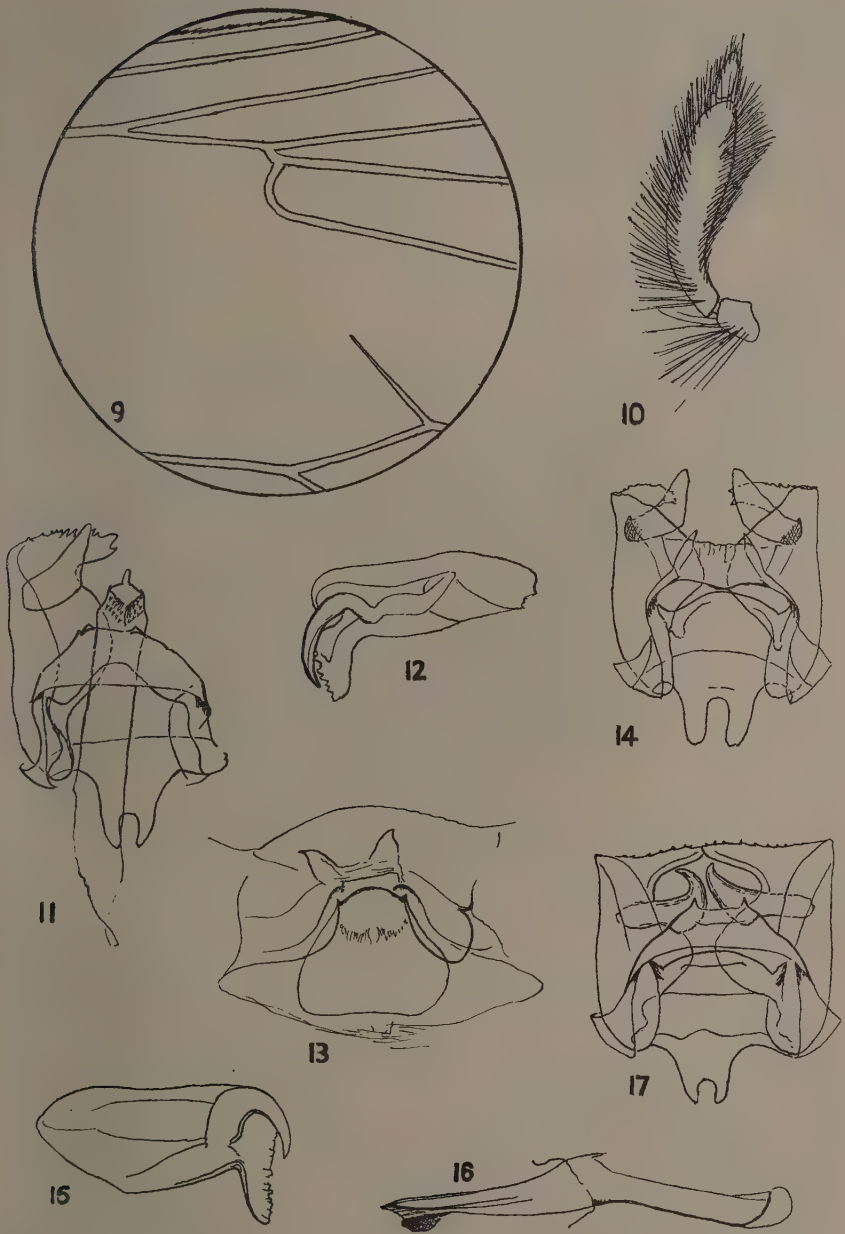
(1) *Atlantea perezi* (Herrich-Schaeffer)

Synchloe perezi Herrich-Schaeffer, 1862, *CorresBl. zool. miner. Ver. Regensb.* **16** : 119. Loc. Cuba.

Figures : Staudinger and Schatz, 1888, *Exot. Schmett.* : Pl. 36.
Seitz, Pl. 91*h*.

Expanse : ♂ 46–58 mm., ♀ 52–58 mm.

Wing pattern, with black macules and fasciae upon a brown ground colour, quite distinctive ; on upper surface of fore wings a postdiscal series of small white spots present, not occurring in



Figs. 9–17.—(9–13) *Atlantea perezi* : (9) fore wing, neuration of disco-cellular area ; (10) palpus, male ; (11) male genitalia, dorsal view ; (12) the same, lateral view of clasp ; (13) female genitalia. (14–16) *A. tulita* : (14) male genitalia, dorsal view ; (15) the same, lateral view of clasp ; (16) penis, lateral view. (17) *A. pantoni* : male genitalia, dorsal view.

the two allied species ; in male, disc of hind wing clear brown with a wide black marginal border and just above this a black cuneiform mark from the body-groove ; in the female, the black border runs round the costa and there is a black discal fascia. Individual variation seems to be very slight.

Anatomical features have been described in generic synopsis.

Biology.—Nothing is known of the life-history of this insect.

Locality.—Isle of Cuba. A long series in the B.M. (N.H.) is so labelled without further information. Eight specimens in the Hall collection are labelled " Santiago, Cuba ".

(2) *Atlantea tulita* (Dewitz)

Synchloe tulita Dewitz, 1877, *Stettin. ent. Zig.* **38** : 238. Loc. Porto Rico.
Holotype : not traced.

Expanse : ♂ 54 mm., ♀ 56 mm.

Apex of fore wing greatly elongated ; upper surface ground colour in male orange-brown with dark brown or black markings ; a series of orange-brown submarginal macules and also a complete series of marginal lunules present in dark shading along outer margin of fore wing. On hind wings the black marginal border very wide, enclosing the orange submarginal macules. Marginal lunules on under surface of fore wings join to form an orange border along hind margin, which includes wing apex. On hind wing a discal fascia of white or yellow macules and some others of same colour at base of wing and along costa ; one large and two smaller macules in the cell orange, and a series of 6 submarginal macules reddish-orange. (Female specimen in the Hall collection is slightly larger than the male, but otherwise very similar, with a complete dark fascia across the cell of the hind wing).

Male genitalia (fig. 14) resemble those of *perezi* very closely ; harpe appears more ponderous and more sharply curved (fig. 15) in *tulita*, and the saccus less prominent ; penis (fig. 16) shows no distinctive character. A single dissection has been made.

Locality.—" Puerto Rico "; no further data (2 ♂).

There is a short series of both sexes in the Am. Mus. N.H. with the following data.—Puerto Rico : Tallaboa, near Ponce (July) ; Quebradillas Jan.–March 1915 ; Arecibo (March).

(3) *Atlantea pantoni* (Kaye)

Chlosyne pantoni W. J. Kaye, 1906, *Entomologist* **39** : 52. Loc. Manchester Mts. ; Jamaica.
Holotype : Coll. W. J. Kaye.
Chlosyne seitzi Rober, 1914, *Seitz* : 453. Loc. Jamaica.
Holotype : B.M. (N.H.).

Figures : Kaye, *loc. cit*, Pl. 2, fig. 6.
Seitz, Pl. 91*h* (*seitzi*).
Avinoff and Shoumatoff, 1941, *Ann. Carnegie Mus.* **28** : Pl. 36, figs. 7/8 ♀, fig. 9, ♂.

Expanse: ♂ 42–50 mm., ♀ 54 mm.

Very similar to *A. tulita* but apex of fore wing less elongated. Ground colour on upper surface golden brown, of paler tone than *tulita* and the dark markings slightly reduced. On fore wing the orange submarginal macules present, but no orange lunules in the dark marginal border. Hind wing shows a wide discal field of ground colour and a rather narrow black marginal border ; on under surface of hind wing the discal and cellular macules all white and arranged exactly as in *tulita*. (In the figure by Seitz the dark markings on the hind wings are more extensive than in any of the male specimens available for comparison at the B.M. (N.H.)). Female striking in appearance ; the paler (brown) areas on both surfaces cream-white, except submarginal macules on hind wing, which remain bright fulvous-red. (First described and taken by Avinoff and Shoumatoff (1941, *loc. cit.*).) *Male genitalia* (fig. 17) appear truncated and almost square in dorsal view ; slightly conical tegumen resembles the structure in *perezi* ; tapered terminal processes of clasps directed horizontally across the organ to meet each other in the mid-line ; each with fine teeth along distal border ; strong harpe also extends horizontally across towards mid-line, curved backwards and downwards in a sickle shape when viewed from a certain angle ; penis resembles the organ in *perezi*. *Female genitalia* have not been examined. A single male specimen has been dissected.

Locality.—JAMAICA.

There are three males and one female in the B.M. (N.H.). One male is labelled " Cockpit Country, 8 miles from Troy ". Other examples, including one female, are preserved in the collection of Mr. W. J. Kaye at Guildford. It appears that the insect is strictly localized in the difficult " Cockpit Country " in N.W. Jamaica, where I am told by Mr. Kaye it is not rare and series of both sexes have been collected by Avinoff and others.

3. **Chlosyne** Butler

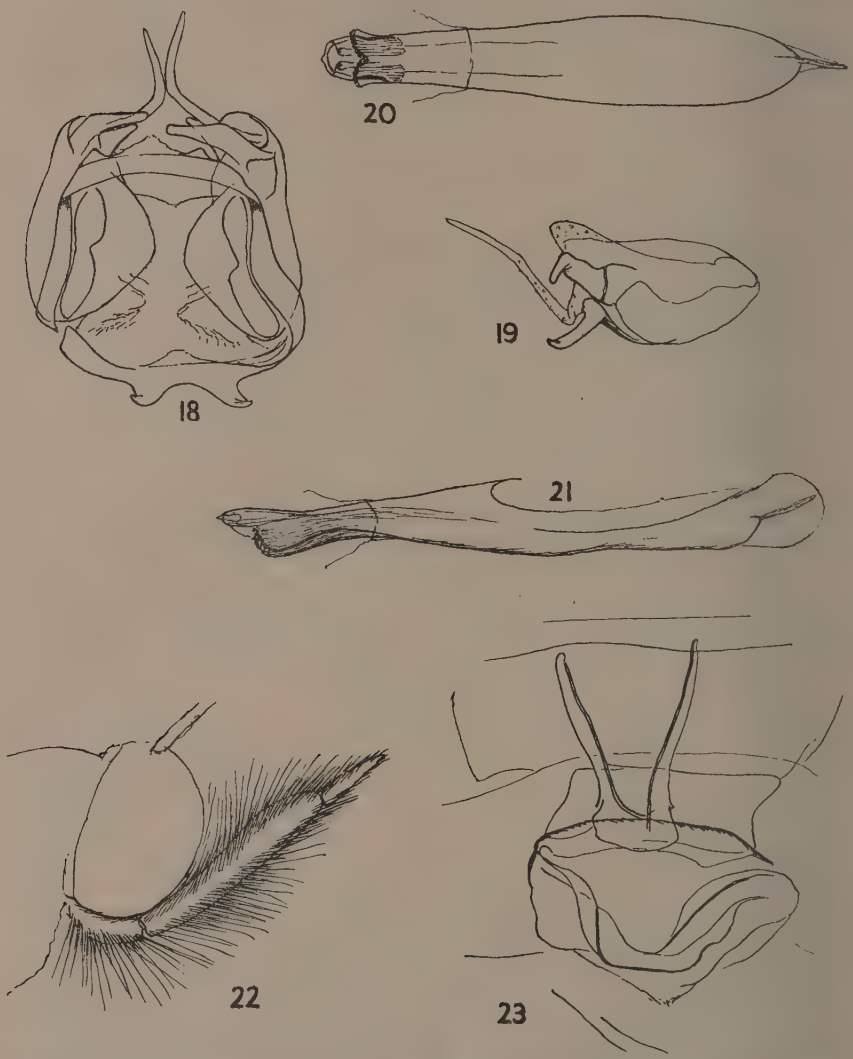
Chlosyne Butler, 1870, *Cistula ent.* **3** : 38. Type-species : *Papilio janais* Drury.

Small or medium-sized butterflies with variable wing pattern ; hind margin of fore wing slightly excavated below nervure 6. *Neuration* (fig. 29) : in fore wing upper disco-cellular nervure developed but rather short, middle disco-cellular concave and continued as nervure 5 (the usual Melitaeine formation) ; lower disco-cellular present, closing half the cell or a little more, rarely almost complete ; cell of hind wing open. *Palpi* are moderately ascending, terminal segment slender, about one-third or more as long as middle segment, hairy above and below, but often with a white line of smooth scales laterally. *Antennae* gradually dilated to an elongated club. *Male genitalia :* well-marked generic characters present ; tegumen wide and simple ; wide ventral plate becoming very thin posteriorly and it is difficult to display posterior margin (fig. 61) ; clasper rather short, with a strong tooth at posterior inferior angle, and a finger-like process, bearing hairs, ascending from posterior margin in all species, except *C. ehrenbergi* (Geyer) ; strongly chitinised harpe directed medially and slightly backwards ; straight penis flattened from above downwards, terminating in a sharp point.

An unusual feature, peculiar to this genus, appears in the position of the suspensory membrane, close to the distal extremity of the penis, so that the proximal limb occupies from three-fourths to four-fifths the total length. Obvious specific characters are present in seven species, but in the remainder, comprising about 17 species, the structure of the genitalia is very uniform and specific characters, if present, may be difficult to identify. The parts are not easy to mount for examination. The claspers are difficult to detach without injury, are cylindrical, and, as they lack a flat base, are easily rotated and a small shift will entirely alter the apparent shape of the processes. At the same time the organs are unusually rigid, and attempts to press flat before mounting have not been encouraging. I have found it most convenient to mount the whole organ and to examine the dorsal and ventral views. In this way it is perhaps easier to ensure comparable views of different preparations. The female genitalia are distinguished by the long double bacillus. These rod-like structures, which support the bursa during life, project into the abdominal cavity. They are attached to the genital shield, which may be tilted when those structures are moved, with marked alteration in the appearances of the anatomy. As a rule several preparations are required to show which characters are sufficiently constant to be of value in specific determination, but generic characters are usually well defined.

At first sight the male genitalia appear quite unlike those of any Palaearctic form, but on closer examination the differences seem perhaps less marked than the resemblance to the typical structure in *Mellicta*, and especially to the species of this genus in which the " uncus " (sub-uncal points) is not developed, i.e. *athalia celadussa* Fruhstorfer and *deione* Geyer. In this genus there is a marked horny process at the posterior inferior angle of the clasp, which may well be homologous with the strong tooth that appears in the same position in *Chlosyne*. In the females the sterigma is commonly larger in *Mellicta* and better defined, but the long double bacillus is a characteristic feature of both genera. The suggestion that these two genera are closely allied receives support from the wing pattern of the *palla* group, which resembles that of the European *athalia* Rottemberg. It is interesting to notice that the wide and shallow tegumen of the male genitalia, which corresponds with the structure in

Chlosyne, is met with in *Mellicta* only in the two species referred to above, which are both confined to south-western Europe. In anatomical characters the species of *Chlosyne* are very uniform. Unexpected features appear only in two species—*C. narva* (Fabricius), in which the arrangement of the nervures closing the cell of the fore



Figs. 18–23.—*Chlosyne janais:* (18) male genitalia, dorsal view; (19) the same, lateral view of clasp; (20) penis, ventral view; (21) the same, lateral view; (22) palpus, male; (23) female genitalia.

wing is unusual, and *C. ehrenbergi* (Geyer), in which the usual finger-like process is absent from the posterior margin of the male clasper. On the other hand, the wing markings are most variable, and on wing pattern the species often appear quite unrelated. On superficial examination the species fall quite naturally into three groups, each with distinctive distribution. These may be referred to as follows :

(*A*) The *lacinia* group. Characteristic of Central America ; the species are frequently polymorphic and mimetic or cryptic, and consequently vary widely from the traditional Melitaeine wing-pattern.

(*B*) The *palla* group. Characteristic of the Western States north of Mexico, probably comprising six species, all of which show a typical Melitaeine wing pattern that recalls the Palaearctic *Mellicta athalia*, and all resembling *C. palla* (Boisduval) so closely that precise specific distinctions are difficult to make.

(*C*) The *harrisii* group. Includes three species only, all with similar markings on the upper surface and a traditional Melitaeine wing-pattern that recalls the Palaearctic species of *Melitaea* associated with *M. phoebe* Schiffermueller.

Although these three groups are obviously distinct by distribution and in external features, they appear to be so closely related by every criterion of structure that I have not been able to find any character that would justify generic separation. Any such distinction would obscure the close relationship that certainly exists between all the species. It seems best, therefore, to speak simply of specific groups.

Examination of the distribution and other characters of this genus shows some unexpected features. The marked dissimilarity in facies between the *lacinia* series and the other two groups is very striking, combined as it is with such close similarity in anatomical features. I do not recall such a distinction in any other group of butterflies. In the *lacinia* group the centre of distribution is clearly Mexico, with eleven distinct species and a number of curious variants, while the entire series of fifteen species occurs in a relatively restricted area extending from Mexico in the north to Venezuela and Colombia in the south. Beyond this region the confusing bizarre forms disappear and only the single species *lacinia*, in the form *saundersi* (Doubleday), has been able to extend its range along the mountains to Trinidad and British Guiana in the east, to Paraguay, Argentina and Chile in the south, and to the north across the Mexican border into southern California, Arizona and Texas, where forms near *saundersi* are accompanied by the melanic *crocale* (Edwards). In Texas, also, three additional species (*janais*, *marina* and *endeis*) appear occasionally as rarities. In view of the geographical position it seems remarkable that no species of *Chlosyne* is known from the Greater Antilles. It may be noted that no species or striking modification (with the possible exception of the xerophilous *californica* (Wright)) has developed beyond the compact area of specific concentration in Central America. Within this area the number and complexity of variant forms (phenotypes) is remarkable in a Melitaeine genus, but corresponds with the picture presented in the same area by other groups, such as *Mechanitis*, *Ithomia*, *Heliconius*, etc.

It seems that *lacinia*, with its near allies, is an example of species showing marked cryptic and mimetic modification in an area of exceptional selection pressure. Elsewhere conditions change, the selective modifications are no longer necessary for survival and *lacinia*, the only species that occurs beyond the critical area, is able to retain its more primitive wing marking and appears only in the form *saundersi*, which is the only phenotype to show a traditional Melitaeine pattern.

The transition to the members of the *palla* groups in California, New Mexico and Arizona is unexpectedly abrupt, dependent possibly upon a climatic change. In this series are developed species characteristic of the desert fauna, others appear in the mountains in woodland clearings, and others again (*malcolmi* and *damoetas*) occur only at great altitudes above the tree line. The butterflies are distributed through the mountainous western States, including the Rocky Mountains, with occasional colonies on the western slopes in North Dakota, Montana and as far north as Manitoba. Further west at least three species (*palla*, *hoffmanni* and *damoetas*) have penetrated into southern British Columbia to Mt. McLean and Salmonarm at about the 50° North Latitude, equivalent approximately to the latitude of London, England. As far as is known, there are not any arctic representatives in the vast

mountainous territories of northern British Columbia, Yukon and Alaska, in contrast with the Palaearctic *Mellicta*, which has extended its habitat far beyond the Arctic Circle, to the extreme north of Europe and Asia, to a latitude of 70°. The butterflies of this group are very local, and it is quite likely that the species are more generally distributed in the mountains of the north-western States than actual records suggest. The greatest concentration of species is in California (5), Colorado (4) and Utah (4).

In the wide expanse of relatively low-lying country in Southern Canada and the United States east of the Rocky Mountains, only three species are found. All show a typical Melitaeine wing pattern on the upper surface, although the marking is unlike that seen in the *palla* group, but with something in common with *lacinia saundersi* (Doubleday). Two of these species, *nycteis* (Doubleday) and *gorgone* (Huebner) have a most extensive distribution. It is difficult to obtain precise information of their total range, but there is no doubt that they both extend far into the Rocky Mountains in Colorado (Brown, 1957) though rarely crossing the Continental Divide and without invading the western slopes, so that they are both absent from the true territory of the *palla* group in the far western mountainous States. Both species have extended their distribution towards the south-west to Arizona (*nycteis*) and Mexico (*gorgone* Klots, 1951). The latter species appears to be absent from the northern States east of Michigan, where it is replaced by *harrisii*, the third species of the group, which flies in the region of the Great Lakes and eastwards through Southern Canada and the northern Maritime Provinces to Maine and Nova Scotia, where it is the single representative of the genus. In structure, in both sexes, this butterfly is very close to typical members of the *lacinia* and *palla* groups, and its restriction to a habitat on the periphery of the generic distribution is rather surprising.

Distribution Chart of *Chlosyne*

Canada. Quebec : **nycteis.**
Ontario : **harrisii, nycteis.**
Nova Scotia and New Brunswick : **harrisii.**
Manitoba : **harrisii, nycteis, gorgone.**
Alberta : acastus.
British Columbia : palla, damoetas, hofmanni.

U.S.A. Middle West : **harrisii, gorgone.**
Eastern States : **harrisii, nycteis.**
Washington : palla, hofmanni, gabbii?
Oregon : palla, hofmanni.
Idaho : palla, acastus.
Montana : palla, acustus, **gorgone.**
N. Dakota : acastus, **gorgone, nycteis.**
Wyoming : palla, damoetas.
Nevada : palla, acastus, gabbii.
Utah : palla, acastus, gabbii, hofmanni.
Colorado : palla, acastus, damoetas, gabbii, **gorgone.**
New Mexico : *lacinia*, palla, acastus, gabbii, **nycteis.**
California : *lacinia*, palla, acastus, gabbii, hofmanni, malcolmi.
Arizona : *lacinia*, *definita*, acastus, **nycteis.**
Texas : *lacinia*, *janais*, *ehrenbergi*, *definita*, *endeis*, **gorgone, nycteis.**

Mexico : *janais*, *hippodrome*, *ehrenbergi*, *lacinia*, *melanarge*, *erodyle*, *eumeda*, *marina*, *endeis*, *definita*, **gorgone.**

Guatemala : *janais*, *rosita*, *hippodrome*, *gaudealis*, *lacinia*, *melanarge*, *erodyle.*

Honduras : *janais*, *gaudealis*, *lacinia*, *melanarge.*

Salvador : *janais*, *gaudealis*, *lacinia*, *melanarge.*

Nicaragua : *janais gaudealis*, *hippodrome*, *lacinia*, *melanarge*, *erodyle.*

Costa Rica : *janais, hippodrome, gaudealis, narva, lacinia, melanarge, poecile.*
Panama : *janais, hippodrome, narva, lacinia, poecile.*
Colombia : *janais, hippodrome, narva, lacinia, poecile.*
Venezuela : *hippodrome, narva, lacinia, poecile.*
Ecuador : *lacinia.*
Peru : *lacinia* (*saundersi*).
Bolivia : *lacinia* (*saundersi*).
Brazil : *lacinia* (*saundersi*).
Chile : *lacinia* (*saundersi*).
Argentina : *lacinia* (*saundersi*).
Paraguay : *lacinia* (*saundersi*).
Trinidad : *lacinia* (*saundersi*).
British Guiana : *lacinia* (*saundersi*).

Note.—*lacinia* group in italic type
palla group in ordinary type
harrisii group in bold type

(*A*) The **lacinia** group

This group consists of 14 or 15 species which occur in Central America, with Mexico as the centre of distribution. A few species extend their range into the neighbouring districts of South America, to Venezuela and Colombia, and *C. lacinia* has spread widely into Chile and western Argentina, and also northwards to Texas, Arizona and southern California. Most often the butterflies occur at moderate elevations, often at the borders of forest paths, but some at least can tolerate near desert conditions (*C. definita* (Aaron)). The wing markings are variable and unlike the usual Melitaeine type, but a small red point or streak at the extreme base of the fore wing beneath the costa is a common feature in many species. Only in the case of the polymorphic *C. lacinia* does a form appear with a wing pattern of black macules and fasciae upon an orange ground-colour which is so typical of most species of Melitaeine butterflies. Many species are members of mimetic associations, of which two at least appear to be quite extensive. The most obvious is the large group centred round the Ithomiine models *Napeogenes larina* Hewitson, *Ceratinia callispila* Bates and others, in which the upper surface of the fore wings is dark with small white spots and the disc of the hind wings orange-red. This association includes the nominate form of *C. lacinia* (Geyer) and *C. janais* (Drury), with the closely related *Eresia nigripennis* Salvin, etc., and various forms from other genera. There is a second large association, possibly cryptic, in which both wings are dark on the upper surface with small white spots. This includes the melanic forms *C. lacinia nigrescens* Wright, *C. lacinia adelina* (Staudinger), *C. melanarge* (Bates), *C. hippodrome* (Geyer), *C. janais marianna* Rober and *C. ehrenbergi* (Geyer). Other members of this association include the Erycinid *Hades noctula* Westwood, and the Pericopid moths *Phaloesia saucia* Walker, *Eucyane aletta* Stoll and *Calodesma melanochroia* Boisduval.

(1) *Chlosyne janais* (Drury)

Papilio janais Drury, 1782, *Illust. nat. Hist.* 3 : 22 + Index. Loc. " Sierra Leone ".

Figures : Drury, *loc. cit.*, Pl. 17, figs. 5, 6.
Seitz, Pl. 91*f*.

Expanse : ♂ 44–48 mm., ♀ 50–58 mm.

On upper surface of this handsome butterfly fore wings black marked with small white spots in series ; four white spots in cell of fore wings. Hind wings orange-red, with a wide black border round outer margin ; on under surface the red area replaced by yellow at base of wing and, external to this, a fascia of red macules in cellules 1*b* to 5 (5 macules) followed by small white

internervular submarginal points and yellow marginal lunules; on both surfaces fringes white interrupted with black.

Male genitalia (fig. 18) large and wide, with a shallow tegumen showing a short conical membranous expansion posteriorly; in lateral view of clasp (fig. 19) the posterior inferior tooth and harpe both long and slender; terminal finger-like process about three times length of harpe; in dorsal view turning across to meet opposite process and then both directed posteriorly side by side; seen from above, penis (figs. 20 and 21) straight and widest anteriorly; in lateral view, flattened from above and suspensory membrane placed very far back. *Palpi* (fig. 22) slender, moderately ascending, with a white lateral streak. *Male fore leg* relatively well developed, tarsus long. *Female genitalia* (fig. 23) show a firmly moulded sterigma, sharply limited posteriorly; the usual bifid or double bacillus present.

This species may be confused with the slightly smaller nominate form of *C. lacinia* Geyer. Separation is not really difficult as *janais* does not show any trace of the small red macule under the costa at the base of the fore wing which is present in all forms of *lacinia*, and the macules of the conspicuous red fascia on the under surface of the hind wing do not extend beyond cellule 2. In *lacinia* the narrow red discal fascia terminates in a triangular red macule in cellule 1*b* near the anal angle.

Localities.—Mexico: Misantia (August); Cordoba; Tampico; Oaxaca; Coatepec; Teapatebasco (January–March), etc. Guatemala: San Geronimo; Tucuru—Alta Vera Paz, 1350 feet (March); Motagna Valley, etc. Salvador: San Tecla, 2000 feet, September/October; Apopa 2000 feet. (September); Ilopango 1200 feet. Honduras: San Pedro Sula. Nicaragua: Chontales; Matagalpa. Costa Rica: Cache; Santa Clara Valley, 1200 feet; Port Limon; Guapiles etc. Colombia: Conca Juntas. Panama: Veraguas; Volcan de Chiriqui. Texas: A single ♂ labelled "South-western Texas".

Mexico appears as the principal centre of distribution. It seems rather doubtful whether it is really established in Texas, although there are examples from Pharr and from Brownsville in the Am. Mus. N.H. at New York. The typical form of *janais* is evidently widely distributed and common in many places. It is a polymorphic species and three additional phenotypes are described below, which seem to be extremely local and rather rare. All four forms are very constant. I have not seen intermediates or minor variations such as occur in *C. lacinia*.

(*a*) form *marianna* Rober

Chlosyne hyperia marianna Rober, 1914, *Seitz*: 452. Loc. Mexico, Guerrero.
Holotype: not traced.

Figure: Seitz, Pl. 91*g* (as *adelina*).

Expanse: ♂ 40–56 mm., ♀ 50–56 mm.

On upper surface ground colour of both wings greyish-brown, marked with small white spots arranged as in typical *janais*; a complete postdiscal series of small white dots usually present on fore wings but often absent on hind wings. On under surface fore wings marked as above, but all white points a little larger and traces of yellow marginal lunules present. On hind wings in most examples base unmarked but occasionally indications of yellow macules; a post-discal series of 5 large brownish-red macules, similar to those in *irrubescens*, followed by a complete series of white internervular dots.

Genitalia of a single male dissected appeared identical with those of typical *janais*.

Locality.—Mexico: Guerrero, many specimens without precise data; Cautla; Matamores.

(*b*) form *gloriosa* D. L. Bauer

Chlosyne hyperia gloriosa Bauer, 1960, *J. Lep. Soc.* **13**: 165, figs. 1–4.
Holotype male, allotype female, and 19 *paratypes*, all Tepic, Mexico, August 1954.

In some specimens near *marianna* the first 4 white macules of the postdiscal series on fore wing enlarged to form a prominent costal bar. (This feature is interesting, and probably has a definite

biological meaning, as there is a close approach to the pattern of *lacina adelina* Staudinger, and definite resemblance to *C. hippodrome* Geyer and *C. melanarge* Bates, in all of which the white costal bar forms a prominent feature.) On under surface of hind wings base usually yellow with some irregular black markings, and the usual red submarginal macules present and of a dark subdued colour. Male and female specimens have been seen.

Localities.—Mexico : Sierra Madre ; Tepic ; Jalisco ; Tenacatita.

(*c*) form *irrubescens* Hall.

Chlosyne hyperia irrubescens Hall, 1924, *Entomologist* **50** : 163. Loc. S. Mexico, Cautla.
Holotype : Coll. Hall, Hove.

Agrees in size with typical *janais*, the difference appearing on upper surface of hind wings, where the usual bright red area is replaced by a large central rounded spot of mahogany brown ; on under surface the yellowish area at base of hind wing heavily spotted with black, followed by 5 postdiscal macules, also dark reddish-brown.

Apparently a perfectly constant form ; only males have been seen.

Localities.—Mexico : Cautla ; " Southern Mexico " (no precise data). There is a series of 7 ♂ in the Hall collection, and a single ♂, *ex* Hall, in the British Museum (N.H.).

In the collection at the Am. Mus. (N.H.) there is a good series of *irrubescens* with typical *janais* and *gloriosa*, all from Jalisco and Tenacatita in Mexico, and it seems almost certain that all forms were flying together at the same time.

(2) *Chlosyne rosita* Hall

Chlosyne rosita Hall, 1924, *Entomologist* **57** : 241. Loc. Western Guatemala.
Holotype male : B.M. (N.H.).

Figure : Hall, *loc. cit.*

Expanse : ♂ 36–38 mm., ♀ 50 mm.

Resembles *janais*, but smaller and fore wings narrower with apex slightly more produced. On upper surface of hind wings the red discal area less extensive ; on under surface a broad, yellow basal area with 2 or 3 black macules upon the nervures. No black spots present before postdiscal red fascia, which is composed of 4 (♂) or 6 (♀) dark red internervular macules, each one clearly defined by the black nervures. No marginal lunules. *Male genitalia :* I have not been able to make a preparation.

Hall records that a preparation of the male genitalia made for him appeared to be identical in every way with the organ of *janais*. The absence of the red streak at the base of the costa on the under surface also suggests a close relationship with *janais*. In view of the similarity of the male genitalia, it is difficult to feel sure that *rosita* may not be another phenotype of *janais* ; but, since both forms certainly fly in Guatemala, I think it should be ranked as a species. The well-marked differences in size and shape of the fore wings support this view, since in *Chlosyne* the usual apparent difference in phenotypical modifications is a change in wing marking.

Localities.—Salvador : Santa Tecla, 2000 feet, 2 specimens, including the holotype, in the B.M. (N.H.) ; Ilopango, 1200 ft. Western Guatemala : El Chile, 2300 feet, Sept. ; Amatitlan, 3800 ft., July/Sept. ; Palin, 3600 feet, July/Sept. ; Moran, 3700 feet. One ♀ example from Moran is labelled " type ".

There are 16 specimens from these localities, including 3 males labelled paratypes, in the Hall Collection.

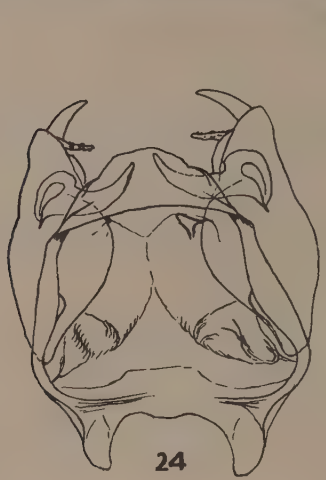
(3) *Chlosyne hippodrome* (Geyer)

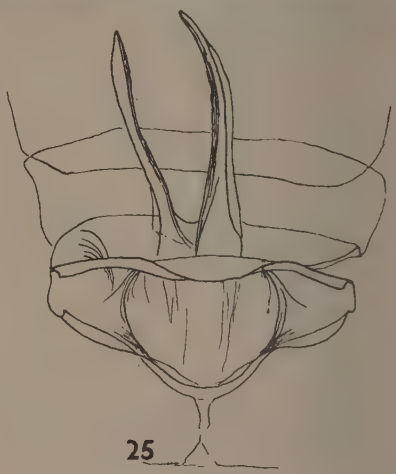
Araschnia hippodrome Geyer, 1837, *Zuträge* **5** : 17. Loc. Mexico.

Figures : Geyer, *loc. cit.*, figs. 863 ; 864.
Seitz, Pl. 91*f*, *g* (as *hyperia*).
Staudinger and Schatz, 1888, *Exot. Schmett.* : Pl. 36.

Expanse : ♂ 45–50 mm., ♀ 55–58 mm.

Rather large species, deep black on upper surface with some white macules in postdiscal area of fore wings. Fringes chequered black and white. On under surface fore wings carry the same markings, and 3 additional white spots in the cell. On hind wings a discal series of 3 to 6 red round macules, followed by a series of small white internervular dots, and a series of large yellow marginal lunules. The red mark appears at base of fore wing beneath costa. *Neuration :* In fore wing lower disco-cellular nervure well developed and cell closed. *Male genitalia* (fig. 24) : large ; with large harpe placed more proximally than usual and short terminal process appearing





Figs. 24–25.—*Chlosyne hippodrome :* (24) male genitalia, dorsal view ; (25) female genitalia.

between this and posterior inferior process. *Female genitalia* (fig. 25) show narrow but well defined sterigma with long double bacillus. *Palpi* with a slender terminal segment ; white lateral line present.

Confusion with *lacinia quehtala* is possible, but the striking pattern on the under-surface of the hind wing in *hippodrome* should make distinction easy. *C. marianna* Rober is also very similar, but the ground-colour is greyish-brown and the white spots smaller. On the under surface the markings of the hind wings are less brilliant, and no red mark is present at the base of the fore wing.

Localities.—Mexico : Atayac ; Cordova ; Oaxaca. Guatemala : Polochic Valley ; Chuacus ; San Geronimo ; Pantaleon ; Panima ; Chacoj ; Teleman. Nicaragua : Chontales. Costa Rica : no further data. Panama : David ; Calobre. Colombia : no further data.

(*a*) form *fabricii* **nom. nov.**

Papilio hyperia Fabricius, 1793, *Ent. Syst.* **3** : 119. Loc. " Indiis ". nec. *Papilio hyperia* Cramer, 1779, *Papillons exotiques* **3** : 74.

Expanse : ♂ 56–60 mm., ♀ 58–66 mm.

This name is required for specimens of *hippodrome* which show yellow macules grouped at the base of the hind wing on the under surface. The form is referred to

by Godman and Salvin who consider it is racial in the southern districts of the distribution area. It may be correct to place it as a weakly marked subspecies. Since the Fabrician name is invalid, another name is required.

Localities.—Colombia. Manaure.

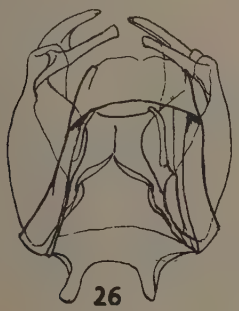
Intermediate specimens with traces of yellow macules are present in the collection from the following localities.—Venezuela : Mucuchachi. Panama : Calobre.

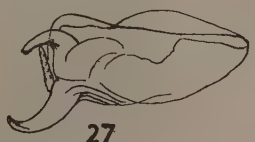
(4) *Chlosyne gaudealis* (Bates)

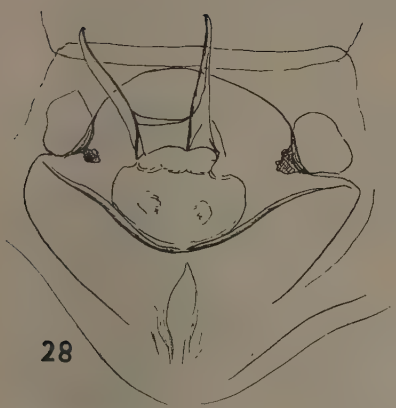
Synchloe gaudealis Bates, 1864, *Ent. mon. Mag.* **1** : 84. Loc. Guatemala.
Holotype : B.M. (N.H.).

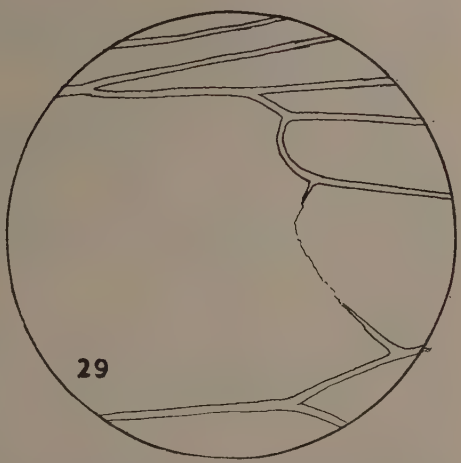
Figure : B.C.A., Pl. 20, figs. 5, 6.

Expanse : ♂ 41–48 mm., ♀ 50 mm.









Figs. 26–29.—*Chlosyne gaudealis :* (26) male genitalia, dorsal view ; (27) the same, clasp, lateral view ; (28) female genitalia ; (29) fore wing, neuration of disco-cellular area.

Fore wing with apex much produced. The wing markings are well known and no confusion with other species is possible.

Neuration (fig. 29) : disco-cellular nervures normal.

Male genitalia (fig. 26) : tegumen less wide but not so shallow as in *janais* ; in dorsal view, harpe and posterior inferior process both appear slender, inclined slightly backwards ; clasp in lateral view (fig. 27) shows the very long posterior inferior process and small finger-like process, not visible from above ; penis closely resembles that of *janais*.

Female genitalia (fig. 28) show the usual bifid bacillus arising from well-defined sterigma. *Palpi* moderately ascending, with a white lateral line.

Localities.—Guatemala: Zapota; Guazacap; Polochic Valley; Cubilguitz; Vera Paz; Teapa-Tabasco. Costa Rica: Guapiles; Volcan de Irazu; Cache. Nicaragua: Chontales. Honduras: San Pedro Sula. Salvador: Sonsonate.

The butterfly was described by Bates from examples he took in the forest region of Northern Vera Paz (Guatemala), where it was common in February and March at an altitude of 1500 feet. It was taken also on the slopes of the Volcan de Fuego at 2000 feet (reported in B.C.A.). The figure referred to above is stated to be "one of the types".

(*a*) form *laeta* Rober

Chlosyne gaudealis laeta Rober, 1914, Seitz: 452. Loc. Nicaragua—Cap Gracias.
Type: probably in Dresden (but *bona fides* uncertain).

Figure: Seitz, Pl. 91*h*.

A minor variant in which the orange-red patch on upper surface of fore wings extends beyond the discoidal cell. (The extent of this red patch is variable, and the two forms often appear together, so it seems unlikely that there is any true subspecific distinction.)

The form *laeta* Rober is represented in the B.M. (N.H.) by examples from Nicaragua, Costa Rica and Honduras.

Note.—This and the following species, *narva* Fabricius, are exceptional in showing the same wing pattern on upper and under surfaces.

(5) *Chlosyne narva* (Fabricius)

Papilio narva Fabricius, 1793, *Ent. Syst. Emend.* 3 (1): 249. Loc. "Africa".

Figures: Jones, *Icones* 4: Pl. 67, fig. 1 (reference by Fabricius).
Doubleday and Westwood, 1846, *Genera of Diurnal Lepidoptera*, Pl. 24, fig. 3.
Seitz, Pl. 91*d*.

Expanse: ♂ 44–47 mm., ♀ 50–52 mm.

It is scarcely necessary to describe this well-known species. The greatly extended apex of the fore wings and the unusual markings suggest the possibility of mimicry of some form of *Euides* or *Heliconius*, but it is difficult to suggest a probable species.

In female, pale markings slightly reduced by extensions of dark ground colour, especially on hind wings, where the basal field is divided completely into a smaller basal macule and a discal fascia, broken up near inner margin.

Neuration unusual (fig. 30): in fore wing upper disco-cellular nervure very short and 6 arises close to 7; middle disco-cellular nervure straight, directed obliquely basally at an unusual angle, cell completely closed. Neuration of hind wing not remarkable.

Male genitalia (fig. 31) recall *gaudealis* Bates. Tegumen wide, simple; clasp (fig. 32) with harpe and posterior process well developed, latter exceptionally long, short finger-like process arising just above it; penis shows the usual generic characters (fig. 34).

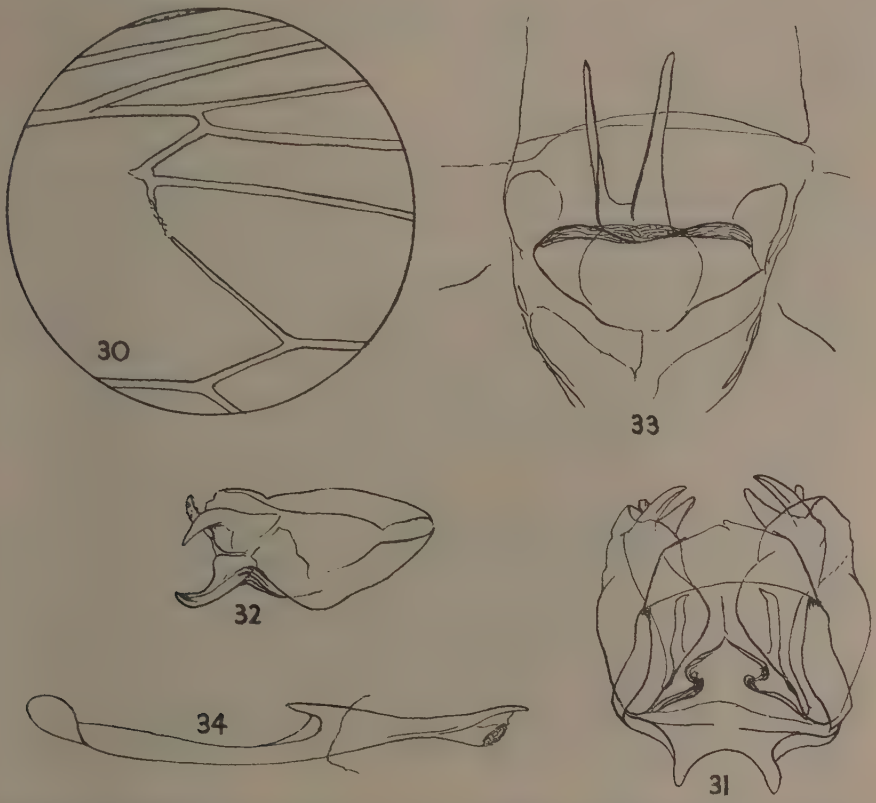
Female genitalia (fig. 33) (one preparation) show short wide sterigma and double bacillus with very long limbs.

Palpi: terminal segment almost half as long as middle segment; of the usual pattern, slender, slightly ascending and with a white lateral line.

Male fore leg: clothed with white hairs and well-developed. Tarsal segment two-thirds length of tibia.

There are two slightly different colour forms of this species. In typical *narva* described by Fabricius the pale macules are yellow. This is the form illustrated by Jones, by Doubleday and by Seitz. Godman and Salvin consider it is restricted to Venezuela and North-eastern Colombia, and possibly should be ranked as a subspecies. The second form is *narva bonplandi* and is described below.

Typical *narva* is represented in the collection at the British Museum (N.H.) from the following localities.—Panama : No further data. Colombia (New Granada) : No further data. Northern Colombia : Manaure. Venezuela : Caracas ; San Esteban ; Marida ; El Mene.



Figs. 30–34.—*Chlosyne narva :* (30) fore wing, neuration of disco-cellular area ; (31) male genitalia, dorsal view ; (32) the same, lateral view of clasp ; (33) female genitalia ; (34) penis, lateral view.

(*a*) form *bonplandi* (Latreille)

Cethosia bonpland Latreille, 1809, *in* Humbolt, *Voy. Reg. Equinox. Nouv. Cont.* : 282. Loc. Peru—Cuença.
Cethosia bonplandi Godart, 1819, *Encyc. Méth.* **9** : 245. Loc. Peru—Cuença.

Figures : Humbolt, *loc. cit.*, 2nd issue, 1811, Pl. 18, figs. 5, 6.
B.C.A., Pl. 20, figs. 7, 8 (rather too pale).

In this form the wing-markings are orange instead of pale yellow. Godman and Salvin regard this as " a western race " that appears in Ecuador and Western Colombia and extends northwards through Panama to Costa Rica. It will be seen that both forms occur in Panama and Colombia. This insect is represented by extensive series in the collection at the B.M. (N.H.) and it appears to be common in many districts. A local form in which the orange basal area on the hind wings is yellow-brown has been described by Staudinger from Chiriqui (Panama) in Staudinger and Schatz (1888. ***Exot. Tagf.*** **1** : 96). I do not know this form in nature.

Localities.—Panama: Lion Hill; Veraguas; Chiriqui. Costa Rica: Irazu; Carrillio; Calobre; Bugaba; Sta. Clara. Colombia: Magdelena Valley (May); Sta. Rosa (August); Tolima; Bogota; Muzo, etc.; Antioquia.

(6) *Chlosyne ehrenbergi* (Geyer)

Morpheis ehrenbergi Geyer, 1833, *Samml. exot. Schmett.* **3**: Pl. 443 (5): Name and figure only.

Figures: Geyer: *loc. cit.*
Seitz, Pl. 93*a*.
Staudinger and Schatz, 1888, *Exot. Schmett.*: Pl. 36.

Expanse: ♂ 45–47 mm., ♀ 50–52 mm.

Both wings grey on upper surface, with 4 or 5 yellowish internervular streaks in apical area of fore wings. On under surface this marking appears again and on hind wings there is a striking pattern of yellowish internervular lines. Prominent red mark at extreme base of both fore and hind wings.

Neuration: cell of fore wings completely closed; that of hind wings quite open.

Male genitalia (fig. 35): the tegumen wide, slightly excavated posteriorly on each side of mid-line and often continued backwards in a short membranous cone; clasp in lateral view (fig. 36) wide and short; harpe and strong posterior tooth not distinctive; usual terminal finger-like process not developed; penis with usual generic characters.

Female genitalia (fig. 37): a rather short double bacillus arising from simple sterigma; narrow belt of modified and thickened chitin before and behind plate.

Palpi (fig. 37*a*): moderately ascending with slender terminal segment almost half length of middle segment.

Localities.—Texas: "Texas", no further data. Mexico: Jalapa; Colima; Oaxaca; Salle; Anemeca; Guerrero, etc. Recorded from the eastern slopes from Hidalgo (4500 feet) and Michoacan (6500 feet) by Brown, 1944, *J.N.Y. ent. Soc.* **52**: 348.

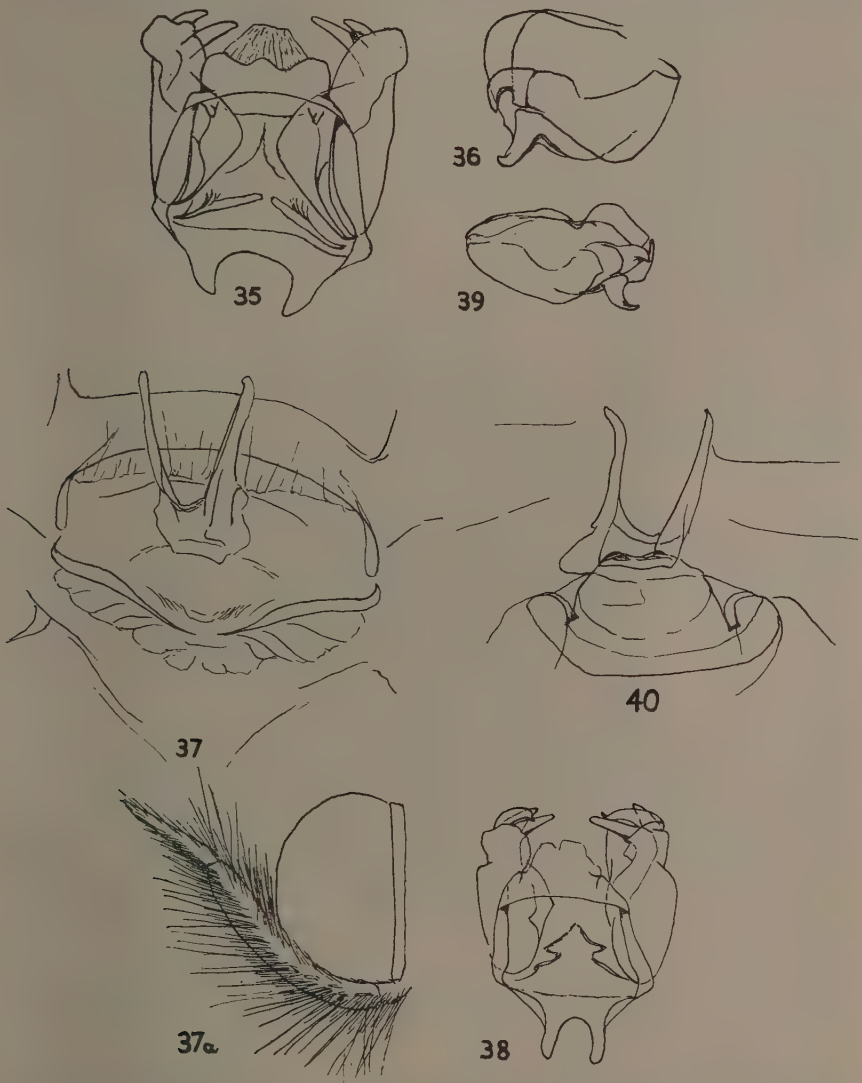
This butterfly differs from other species in the genus in the absence of the terminal process of the clasp of the male genitalia. It agrees perfectly in other details of structure and seems quite well placed beside *janais* Drury and *lacinia* Geyer. It is specified as typical species of *Morpheis* Geyer, 1833, but this name is invalid and preoccupied by *Morpheis* Huebner, 1822, which is composed of quite different species. In fact the structural differences do not seem sufficiently important to justify separating *ehrenbergi* in another genus.

In the following species the male genitalia are all very similar and in many cases it is difficult to detect even minimal distinctive specific characters. The female genitalia possibly give more reliable specific features, but often it is difficult to find sufficient material to exclude individual variations in the parts when preparations are made from old dried specimens.

(7) *Chlosyne lacinia* (Geyer)

The most superficial consideration of this polymorphic species will indicate the complexity of its composition. The various forms fall into two categories. In the first place there are four easily recognisable and dominant constant forms, each remarkably distinct in superficial facies, *viz. lacinia* (Geyer), *adelina* (Staudinger), *crocale* (Edwards) and *saundersi* (Doubleday). In some districts two or more of these may occur together, or one or other may appear in a given area as the exclusive representative of the species. In the second place there are specimens that are found singly with less constant and often intermediate characters, which recur sufficiently often to need a name, and in rare cases with exceptional bizarre wing-patterns. It is hard to decide upon the correct taxonomic rank of these component forms, difficult to describe the series in acceptable nomenclature and equally hard to assess the

biological significance of the extreme range of variation which is certainly without parallel in the Melitaeinae and hard to match in any other butterfly. A suggestion of true subspecific status is challenged by consideration of the overall picture when various dominant forms are found to intergrade and subspecific boundaries become



Figs. 35–40.—(35–37*a*) *Chlosyne ehrenbergi :* (35) male genitalia, dorsal view ; (36) the same, lateral view of clasp ; (37) female genitalia ; (37*a*) palpus, male. (38–40) *C. lacinia :* (38) male genitalia, dorsal view ; (39) the same, lateral view of clasp ; (40) female genitalia.

difficult to define. It seems more likely that we are dealing with a range of colour forms, elaborated as components of different mimetic or cryptic associations, but without true geographical significance except possibly as determined by their models. In this situation I have decided to treat the four principal dominant forms as " phenotypes " using a trinomial nomenclature in order to conform with custom, but with

the reservation that the fact of subspecific status has yet to be established. The rarer intermediate and aberrant forms are placed simply as " forms " without further explanation, and associated with one or other of the principal phenotypes as seems best.

It is only natural that each of the major forms was described in the first place as a separate and distinct species. The earliest statement that I have seen indicating the correct status of these forms was made by Godman and Salvin in the first volume of the *Biologia* (1882), in which there are illustrations of six different phenotypes. Their observations were quickly confirmed by Aaron (1884, *Papilio* **4** : 178) who recorded *saundersi*, *adjutrix* and *mediatrix* flying together in Texas. This is quite a remarkable record, as the possibility of polymorphism was scarcely recognized by most entomologists at this date, when Trimen was only beginning to publish the results of his observations on polymorphism among the butterflies of South Africa. Further knowledge of the distribution, bionomics and genetics of this exceptional series will be needed before it is possible to form a confident decision of the most accurate presentation from the taxonomic angle. The total distribution of *lacinia* in its various forms is very large, but much of the area is relatively inaccessible. While the material in the collection is quite extensive, it is not sufficiently representative to allow a complete analysis of the distribution of the several forms of this variable butterfly. This is especially true of the south-western United States north of Mexico. With this reservation I will attempt a short account based upon the material available.

The single form *saundersi* occurs with minor modification throughout the entire distribution area of the species, from Texas and Arizona in the north to western Argentina, Chile and Brazil in the south, though possibly not in all localities. In the north *saundersi* appears slightly modified in the form *adjutrix* Scudder, with a dark basal area on the upper surface of the hind wing. This form predominates in Texas and is represented in the Am. Mus. N.H. from Arizona ; it is said, by Holland, to occur also in New Mexico and occasionally in California, although I have not seen any specimens to support this statement. In some desert biotopes in Arizona and Southern California *adjutrix* is further modified to appear as *californica* (Wright), an extreme " dry " form in which the ground-colour on the upper surface is pale sandy-yellow and the dark markings are reduced in extent Transitional specimens leading to typical *adjutrix* appear in some districts (*e.g.* Brewster Co., Texas). Throughout the south-western States, except possibly in eastern Texas, there appears also the melanic form *crocale* (Edwards). Our material suggests that this form predominates in Arizona, but it is represented too from Mexico (Sonora), New Mexico and California. In many places it is likely that the two forms fly together, or at least in close association. Cockerell has recorded in a letter published by W. H. Edwards (1893, *Canad. Ent.* **25** : 286) that he found at Juarey, in northern Mexico, both *crocale* and *saundersi* on the same day, the latter *in cop.* with nominate *lacinia*. In this letter he makes observations on the larvae of the species at Las Cruces in New Mexico, which appear in three colour forms, red, black and black with a red dorsal stripe, which he duly names *rufa*, *nigra* and *bicolor*. From a single brood he obtained 19 *crocale* and 9 *saundersi* (? *adjutrix*) forms, but the colour of the larva did not give any indication of the type of imago. He remarked further that the larvae, feeding upon sunflowers, exposed themselves upon the upper surface of the leaves in the most reckless manner.

Slight further modification of *crocale* leads to *quehtala* (Reakirt) and *adelina* (Staudinger), in both of which melanism is highly developed and the pale discal fascia disappears from the upper surface of the hind wing. While *crocale* is found only in the north, the *quehtala* series appears first in Mexico and is commonest in equatorial regions. Another complete change of facies appears in the nominate form of *lacinia* (Geyer), in which the melanic fore wing is combined with an extensive orange-red discal area on the upper surface of the hind wing. Although transitional specimens

may be found in Arizona, *lacinia* appears first as a dominant form in Mexico, and it extends southwards from there through Central America to Costa Rica, associated with melanic forms and with *saundersi*. Further south *lacinia* becomes more rare. This form is clearly a member of the extensive mimetic association which has for models the numerous Ithomiine species with dark fore wings marked with small white spots and red hind wings. As these butterflies are essentially tropical in distribution, the absence of nominate *lacinia* from the northern and southern areas of specific distribution is easily explained.

The different phenotypes do not all occur with equal frequency in every part of the distribution area. The relative frequency of each form can only be estimated by collecting on the spot, and the only information upon this matter that I can discover is that given by Godman and Salvin in the *Biologia*, where the following observations are made. In Mexico typical *lacinia* occurs with the extreme melanic forms, which probably predominate slightly. On the other hand, nominate *lacinia* is certainly more frequent in Guatemala, although melanic forms with intermediates do occur. In Nicaragua *saundersi* is most common, (and this is the only form I have seen from Ecuador, where it appears in a form (*fassli* Rober) which is scarcely distinguishable from *adjutrix* of Texas). Melanic forms again are most common in Costa Rica and in Panama, but throughout all South America it is *saundersi* undoubtedly that predominates, with occasional abnormal forms with a melanic tendency. There is no record of any observations that could explain this wide variation, which may probably be determined by alterations in biotope or the presence of different models which would naturally influence the appearance of mimics.

Neuration : In the fore wing upper disco-cellular nervure short and middle disco-cellular convex inwards ; lower disco-cellular nervure well developed and tubular in its lower two-thirds.

Male genitalia (fig. 38) of usual pattern with wide tegumen showing membranous posterior expansion ; clasp (fig. 39) bearing rather short terminal finger-like process directed obliquely medially ; penis (not figured) without special feature.

Female genitalia (fig. 40) show usual bifid bacillus.

Palpus slender, obliquely ascending with terminal segment about one-third length of middle segment.

This remarkable species, with a complex series of different colour forms, shows two constant external markings. These consist of (1) the minute red streak which appears at the extreme base of the fore wing beneath the costa in so many species of the genus, but which is lacking in *janais* (Drury) with which species in its various forms *lacinia* can be confused ; (2) a small red or orange mark on the under surface of the hind wing where the inner margin meets the anal angle in cellule 1*b*.

The principal named forms are described below.

(*a*) *lacinia lacinia* (Geyer)

Araschnia lacinia Geyer, 1837, *Zuträge* **5** : 25. Loc. Mexico
Synchloe tellias Bates, 1864, *Ent. mon. Mag.* **1** : 84. Loc. Guatemala and Honduras.
Holotype male : B.M. (N.H.).
Synchloe mediatrix Felder and Felder, 1867, *Reise Novara* **2** (3) : 395. Loc. Bogota.
Holotype male : B.M. (N.H.).

Figures : Geyer, *loc. cit.*, figs. 899–900.
Holland, Pl. 18, fig. 10 (as *janais*).
Seitz, Pl. 91*d* (as *mediatrix*).
B.C.A., Pl. 19, figs. 6, 7 (*mediatrix*).

Expanse : ♂ 37–39 mm., ♀ 38–41 mm.

On upper surface fore wings show the usual arrangement of small white spots, with small macules in the cell and in cellules 1*b* and 2 ; discal field of hind wing orange-red with a wide black border along outer margin, and in many examples some black shading at base of wing and along

body groove. On under surface of the hind wing a yellow fascia of variable width, sometimes extending almost to base; external to this lies a band of orange-red macules, more or less developed, of which the mark in cellule 1*b* is always present.

This constant and dominant form is widely distributed and common in the central districts of the distribution area, but probably does not occur north of Mexico except as a straggler.

The name *mediatrix* was given to a form in which the white spots upon the upper surface of the fore wings, and especially those of the costal bar, are slightly enlarged, a small difference that really comes within the normal range of variation of *lacinia* forms. I am tempted to suppose that the Felders were not familiar with Geyer's figure when *mediatrix* was described, and the same may be said of Bates, since his *tellias* represents the same insect. The name *mediatrix* has been employed occasionally when nominate *lacinia* has been referred to, but in my view it is not required and should be treated as a synonym of *lacinia*. This insect may be confused with *Chlosyne janais* (Drury), which is a larger insect without the small red streak at the base of the fore wing beneath the costa. The markings on the under surface of the hind wings are also very different.

Localities.—Texas: One example without further data. Mexico: Misantla; Vera Cruz—Atoyac; Oaxaca; Tealpa; Orizaba; Espinal; Yucatan. Guatemala: Polochic Valley; Duenas; Yzabal; Motagua Valley; Santa Maria Valley (Pacific Slope); Guizacapan, *etc.*, a long series. Honduras: San Pedro Sula; Tegucigalpa. Nicaragua: Camoapal; Rio Wanks; Jinotega, 3400–4400 feet; Matagalpa, 2600 feet. Costa Rica: San Mateo; Cartago; Limon; Irazu, 7000 feet. Salvador; Ilopango; Santa Tecla (2 examples only). Panama: Calobre; Veragua; Palenka (3 examples only). Colombia: San Francisco; Bogota.

(*b*) form *indigens* Hall

Chlosyne lacinia indigens Hall *in litt.*

Figure: B.C.A., Pl. 19, fig. 14.

This name may be used for the modification of *lacinia* in which the red field of the hind wings is reduced to a small discal area or to a series of red internervular macules across the disc. As a rule there is not any development of the usual yellow fascia on the under surface of the hind wings. The form seems to occur quite commonly in some areas, *i.e.* in Costa Rica, and there are good series in the B.M. (N.H.) and in the Hall collection standing under the M.S. name *indigens*.

Locality.—Costa Rica: Escazu (October).

(*c*) form *montana* Hall

Chlosyne lacinia montana Hall, 1924, *Entomologist* **57**: 241. Loc. Mexico, Popacatapetl.
Holotype: B.M. (N.H.).

Expanse: ♂ 31–36 mm.

Small form, with fore wings narrow; postdiscal macules on fore wings rather exaggerated. In all other respects markings correspond exactly with those of nominate *lacinia*.

In addition to the holotype there are two male paratypes in the collection and there are three male paratypes in the Hall collection, all from Popacatapetl, taken at an altitude of about 10,000 feet. This form may be regarded as *lacinia* modified by sub-alpine conditions at a high altitude, and the small size is no doubt due to ecological factors. Hall notes that he saw about 20 specimens in a Mexican collection and no other form of the butterfly was met with upon the mountain.

(*d*) *lacinia crocale* (W. H. Edwards)

Synchloe crocale W. H. Edwards, 1874, *Trans. Amer. ent. Soc.* **5** : 17. Loc. White Mts., Arizona.
Type : not traced.
Chlosyne lacinia var. *rufescens* Cockerell, 1894, *Canad. Ent.* **26** : 30. Loc. Mexico. nec *Chlosyne lacinia* var. *rufescens* W. H. Edwards, 1893, *Canad. Ent.* **25** : 286.

Figures : Holland, Pl. 24, figs. 8, 9 (as *crocale*).
Idem., Ed. 2, Pl. 59, fig. 18 (yellow form as *rufescens*).
Wright, Pl. 21, fig. 209 (white form as *crocale*).
Idem., fig. 210 (yellow form as *rufescens*).
Idem., fig. 208 transitional to *californica* (as *lacinia*).
Seitz, Pl. 91*f* (yellow form).
Comstock, Pl. 39, fig. 19 (white form *crocale*).
Idem., fig. 20 (yellow form as *rufescens*).

A melanic form. On upper surface markings on fore wings reduced to the white discal spots of which four costal macules are most prominent, whole series forming an incomplete fascia across disc of wing. Series of white submarginal dots also present with traces of paler marginal lunules. On hind wing area of ground colour reduced by extension of dark basal shade to make a narrow fascia, white or pale orange-yellow. On under surface this pale fascia forms a prominent marking across disc of hind wing.

The form *crocale* is dominant in the northern regions of the distribution area, and particularly in Arizona, sometimes accompanied by forms near *saundersi* and intermediates. It does not appear in Central America where its place is taken by the similar *quehtala* series of forms. Among true *crocale* occasional specimens occur in which the white fascia on the upper surface of the hind wings is nearly obliterated, represented only by a few pale scales or obsolescent macules. Such specimens may be referred to *nigrescens* W. H. Edwards (1893, *Canad. Ent.* **25** : 286), illustrated under this name by Comstock (Pl. 39, fig. 21) and by Wright (fig. 211). I have seen this minor modification only from Arizona and southern California, and it does not appear in Central America, so the form is properly considered as a form of *crocale*. The name *rufescens* has been used by Wright and later by Comstock and by Holland for examples showing a pale orange discal fascia, sometimes tinted with pink on the upper surface of the hind wings and figured by Holland on Pl. 59, fig. 18. In series the fascia is quite variable, with every grade of colour from white to pale orange-pink, and the distinction of two forms is rather artificial.

The name *rufescens* and its application is considered below.

Localities.—California : Imperial Co. ; Riverside Co. ; Brawley ; Indio. Arizona : Fort Grant. Texas : El Paso. New Mexico : Water Canyon. Mexico : North Sonora ; Guadelajara ; Durango ; Predisio.

Note.—Dr. Harry Clench tells me that there are 3 ♂ and 2 ♀ of *crocale* in the W. H. Edwards collection at Pittsburgh, all from Arizona *ex* Morrison, but not any one marked "type". In my view it would not be unreasonable to select a lectotype, from this small series.

Note concerning the name rufescens.

Chlosyne lacinia var. *rufescens* (Cockerell M/S) W. H. Edwards, 1893, *Canad. Ent.* **25** : 286. Loc. Juarey, Mexico.
Chlosyne lacinia var. *rufescens* T. D. A. Cockerell, 1894, *Canad. Ent.* **26** : 30. Loc. Juarey, Mexico.
Chlosyne lacinia form *flavida* **nom. nov.** pro *rufescens* Cockerell, 1894, *nec* Edwards, 1893.

This name published by W. H. Edwards was based upon specimens and notes sent him by T. D. A. Cockerell, and applied to two varieties of *lacinia* which were described as follows.—" In one there is a broad red band across both wings reaching nearly to the costa of the primaries, with marginal red spots on both wings ; the other has the red band half wider than usual and of a deep colour, but there is nothing of

it on the fore wing, nor are there any marginal red spots." I have not been able to identify the varieties described ; there is nothing comparable from Northern Mexico in the collection. The later description by Cockerell (1894) clearly refers to the common form of *crocale* in which the pale fascia on the upper surface of the hind wings is yellow or orange, sometimes with a pinkish reflection.

It seems impossible to me to suppose that Edwards in his note of 1893 was referring to the same insect that Cockerell described in his short note of 1894. In these circumstances *rufescens* Cockerell, 1894 must become a homonym of *rufescens* Edwards, 1893 (nomen dubium). If a distinction is required between the forms of *crocale*, specimens with an orange or yellow fascia on the upper surface of the hind wings may be referred to as form **flavida**, *nomen novum* for *rufescens* Cockerell *nec* Edwards.

(*e*) *lacinia quehtala* (Reakirt)

Synchloe quehtala Reakirt, 1866, *Proc. Acad. nat. Sci. Philad.* **1866** : 248. Loc. Mexico.
Type : lost ?
Synchloe ardema Reakirt, 1866, *Proc. Acad. nat. Sci. Philad.* : 366. Loc. Vera Cruz, Mexico.
Type : lost ?
Synchloe misera C. and R. Felder, 1869, *Verh. zool.-bot. Ges. Wien* **19** : 471. Loc. Huahuapan, Mexico.
Type : B.M. (N.H.).
Synchloe pretona Boisduval, 1870, *Lep. Guatemala* : 37. Loc. Guatemala.
Type : not traced.

Figures : B.C.A., Pl. 19, figs. 16, 17 (*quehtala*).
Seitz, Pl. 91*e* (*quehtala* as *nigrescens*).

Melanic form ; ground colour of all wings black or dark brown ; on upper surface of fore wings markings resemble those of typical *lacinia*, with a postdiscal series of 4 or 5 white macules and a complete submarginal series of small white points ; on hind wings white points often scarcely visible and discal field devoid of markings. (In describing *quehtala* Reakirt remarked upon the close resemblance to the wing pattern of *C. hippodrome* Geyer. The original specimen is described as showing on the under surface a yellow fascia across the disc of the hind wing, but in series the presence of this fascia is quite variable ; it may be vestigial or altogether absent.)

The name *misera* C. and R. Felder, also described from Mexico, is probably quite synonymous with *quehtala*, and it is difficult to discover any marked distinctive feature in the description of *ardema* Reakirt. Unfortunately the original type specimens for both these names are missing from the Reakirt collection today. The form *pretona* Boisduval from Guatemala is described as having complete markings of yellow basal macules and discal fascia with red sub-marginal macules on the under surface of the hind wing. Since these forms only differ in small details it is convenient to group them under a single name and *quehtala* Reakirt has priority.

Localities.—With pale fascia present on under surface of the hind wings. Arizona : Fort Grant. Mexico : Guerrero ; dos Arroyos ; Hacienda de la Imogen ; Tierra Colorada ; Orizaba ; Lake Chapala. Colombia : Rio Frio, 4000 feet ; Santa Marta ; " North Colombia ". Costa Rica : no precise locality. Bolivia : Coroico, 6000 feet. Peru : Dept. Amazonas. Venezuela : San Esteban.

Without the pale fascia on under surface of the hind wings. Mexico : Guerrero ; Venta de Zapilota, 2500 feet ; Rincon. Costa Rica : Santa Clara valley, 1200 feet ; Irazu ; San Francisco, 4500 feet ; Salvador : Apopa, 2000 feet ; Vera Cruz : Cordova. Guatemala : Polochic valley.

(*f*) form *adelina* (Staudinger)

Synchloe adelina Staudinger, 1875, *Verh. zool.-bot. Ges. Wien* **25** : 102. Loc. Panama.

The name *adelina* Staudinger is available for a very similar form in which there is a prominent costal bar of white macules on the upper surface of the fore wing. The

under surface of the hind wing is almost unmarked in all specimens seen. It is worth while retaining this as a distinct form as there is such a marked approach to the pattern seen in *C. melanarge* Bates. At present I have seen *adelina* only from Panama and Costa Rica.

Localities.—Panama : Chiriqui ; " Canal Zone "; Calobre ; Palenka Island ; Insoleta Island ; Veraguas. Costa Rica : Irazu ; " Costa Rica ".

(*g*) form *paupera* (C. and R. Felder)

Synchloe paupera C. and R. Felder, 1867, *Reise Novara* **3** : 395. Loc. Bogota, Colombia.
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 19, figs. 12, 13.

Melanic form ; no discal markings on upper surface ; on fore wings white postdiscal macules of costal bar near apex enlarged and strongly washed with orange, giving quite a bizarre pattern. In holotype a short ochreous fascia on under surface of hind wings. (Among 19 examples grouped under this name in the collection there is much variation and it is not easy to define the limits within which the use of this name is appropriate.)

Distribution.—This occasional form has a wide distribution in the area where *saundersi* and *quehtala* occur together. In more or less typical examples it is represented in the collection from the following localities.—Colombia : Bogota. Bolivia : Coroico ; Santa Marta. Peru : Dept. Amazonas. Venezuela : San Esteban. Costa Rica : No precise data.

(*h*) *lacinia saundersi* (Doubleday)

Synchloe saundersi Doubleday, 1848, *Gen. Diurnal Lepid.* : 185. Loc. Venezuela.
Holotype : B.M. (N.H.).

Figures : Doubleday and Westwood, *Gen. Diurnal Lepid.* : Pl. 24, fig. 2.
Seitz, Pl. 91*d*.

Ground colour on upper surface tawny-orange with black markings at base of fore wing and in cell, and a wide black border along outer margins of both wings. Traces of orange marginal lunules present in holotype and in most specimens, often quite developed in female. In typical specimens basal area of hind wing on upper surface clear orange, but traces of black macules often present in this position. On both wings a submarginal series of minute white dots, often more or less obsolete on hind wings. On under surface, ground-colour yellow and white submarginal dots clearly defined, followed by large orange marginal lunules. In many examples a suggestion of paler macules can be seen along inner margin of orange discal fascia on upper surface of fore wings. Female slightly larger than male as a rule, with colour of all markings less intense.

Biology.—Kohler, 1927, *Rev. soc. ent. Argent.* **5** : 3–4 and figs.

The larvae live in colonies upon *Helianthus*, and only separate to pupate. When small the colour is chestnut-red, but many get much darker as they grow, sometimes almost black with red spines. Kohler adds that the darker forms of the butterfly are commonest in the spring ; autumn specimens are usually paler, with more extensive orange-brown fields on the upper surface. There are several broods each year in Argentina.

Localities.—Mexico : Guerrero ; Santa Cruz (early May). Nicaragua : Camoapa (3 specimens). Panama : " Panama " no further data (2 males). Colombia : Sta. Marta ; Popayan ; Cauca Valley ; Bogota, *etc.* Venezuela : Merida ; San Esteban ; Carupano ; Valencia. British Guiana : No further data (1 female). Trinidad : A series dated December/February. Brazil : Corumba. Ecuador : A series very near *adjutrix* Scudder (*fassli* Rober). Peru : Charape, 4000 feet ; Pozzuzo ; Dept. Amazonas ; Western Slopes of Andes at 4000 feet ; Reitema Falls ; Upper Maranon. Bolivia : Coroico ; Yungas (1200 m., Nov.) ; Chulumani ; Cochahamba. Paraguay: Estanzio Cooper (Alto Paraguay) ; Villa Rica ; Asuncion. Argentina (only in the

north (Kohler)): Salta; Missiones; Tucuman; Castro Parano; La Rioja. CHILE: Santiago; La Bonda; Cordilleras (Dec.) (3 specimens).

(*i*) form *adjutrix* Scudder

Chlosyne adjutrix Scudder, 1875, *Bull. Buffalo Soc. nat. Sci.* **2**: 269. Loc. Texas.
Type: not traced.
Chlosyne mediatrix form *fassli* Rober, 1914, Seitz: 451. Loc. Medina, 500 m. East Colombia.
Type: probably in Dresden.

Figures: Wright, Pl. 21, fig. 208 (*adjutrix*).
Holland, Pl. 18, fig. 11 (*lacinia* in 1st Ed.; *adjutrix* 2nd Ed.).
Seitz, Pl. 91*e* (*fassli*).
Pl. 91*f* (*adjutrix*).

Very close to typical *saundersi* and differing chiefly in showing a solid dark basal area on upper surface of hind wings. Orange ground colour restricted to a wide fascia running across both wings. In series a well-marked phenotype, but traces of dark shading are not rare in more typical *saundersi* from Mexico, *etc.* In many specimens that may be placed as *adjutrix* the discal fascia is rather narrow and such specimens show an obvious transition towards *crocale* (*cf.* Seitz, Pl. 91f.)

The form described by Rober as *fassli* only differs on the upper surface from the northern *adjutrix* in the greater development of the yellow macules in the dark shade at the base of the fore wing and of the hind wing beneath, and in the larger orange marginal lunules. In some specimens from Ecuador in the B.M. (N.H.) it is difficult to make any distinction.

Localities.—TEXAS: Bejar Co.; Brownsville (March); Brewster Co. Form *fassli*: ECUADOR: Paramba (March/April).

In the Am. Mus. N.H. there is a long series of *adjutrix* from Brewster Co. and from Globe, Arizona, including many specimens intermediate between *adjutrix* and *californica* Wright. Tinkham (1944, *Canad. Ent.* **76**: 14) records *adjutrix* as very common in Rio Grande Valley, Texas, together with occasional *crocale*. He notes *Verbesiana enceloides* as the food plant of *adjutrix* in this locality.

(*j*) form *californica* (Wright)

Synchloe californica Wright, 1905, *Butt. West Coast*: 170.

Figures: Wright, *loc. cit.*, Pl. 21, figs. 212*a–c*.
Holland, *Ed.* **2**: Pl. 59, figs. 19, 20.

May be regarded as a desert modification of *adjutrix* Scudder, differing in paler tone of yellow ground colour and paler and somewhat reduced black markings on upper surface, with large submarginal lunules. In most specimens discal fascia of fore wings runs entire to costa. Differs from nominate *saundersi* in showing a wide dusky shade at base of hind wing on upper surface, as well as in the above features.

The extreme development of *californica* is met with only in the hot valleys of Southern California and Arizona. Comstock records two annual broods, the first in March/April and the second in September/October. He does not mention any seasonal distinction.

Localities.—SOUTHERN CALIFORNIA: Riverside Co.; Palm Springs (October); Snow Creek. ARIZONA: Yarnell Hill (September).

In the Am. Mus. N.H. there are specimens from San Bernadino Co.; San Diego Co.; and from Cottonwood Canyon in Arizona.

Biology.—Comstock (1929, *Bull. S. Calif. Acad. Sci.* **28**: 53) figures larva and pupa. Larva velvet-black with many small white points, and black spines, but colour rather variable; in some, a suggestion of grey longitudinal stripes and yellow macules at the base of the spines. Pupa lustrous grey with black and brown streaks and spots. Pupal stage only 5 days. Food-plant not recorded.

(*k*) Named occasional forms

(i) *splendida.* *Chlosyne saundersi* form *splendida* Hayward, 1932, *Rev. Soc. ent. argent.* **4** : 66, 181 with figure. The ground-colour on the upper surface very bright orange-yellow, with wide black marginal border to hind wings.

(ii) *reducta.* *Chlosyne saundersi* form *splendida* ab. *reducta* Hayward, 1932, *Rev. Soc. ent. argent.* **4** : 66. The orange macules on the upper surface of the fore wing greatly reduced by extension of the black pattern.

(iii) *infuscata.* *Chlosyne saundersi* form *infuscata* Hayward, 1935, *Rev. Soc. ent. argent.* **7** : 186. The ground colour on the upper surface dark chestnut brown and the black markings more extensive than usual. Loc. Several examples from ARGENTINA : Puerto Aquirre, Prov. Missiones.

(iv) *inghami.* *Chlosyne lacinia refuscens* form *inghami* Gunder, 1928, *Canad. Ent.* **60** : 167, fig. The white costal bar on the fore wings is obscured.

(v) *chinoi* *Chlosyne californica* ab. *chinoi* Gunder, 1924, *Ent. News* **35** : 157. Loc. CALIFORNIA : Palm Springs. An unusual female example with bizarre wing markings, the black submarginal fascia nearly obsolete on the upper surface of both wings. *Figure* : Comstock, Pl. 38, fig. 15.

(vi) *fruhstorferi.* *Chlosyne mediatrix* form *fruhstorferi* Rober, 1914, Seitz : 451. Loc. BOLIVIA. *Figure* : B.C.A., Pl. 19, fig. 10. An occasional form near *adjutrix* in which the orange ground colour on the upper surface is reduced to a narrow fascia across the disc of both wings. There is a single female specimen in the collection from Corosal, British Honduras, but there are 12 examples in the Hall collection.

(vii) *felderi.* *Chlosyne mediatrix* form *felderi* Rober, 1914, Seitz : 451. Loc. COLOMBIA. On the upper surface this form is melanic, with incomplete orange discal fascia on the fore wings and enlarged post-discal macules with orange shading near the wing apex. There is little distinction from *paupera* C. and R. Felder. The specimen is figured by Rober on Pl. 91*e*. Type perhaps in Dresden, but bona fides doubtful.

(8) *Chlosyne melanarge* (Bates)

Synchloe melanarge Bates, 1864, *Ent. mon. Mag.* **1** : 85. Loc. Guatemala (Interior).
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 20, figs. 9, 10.
Seitz, Pl. 91*f*.

Expanse : ♂ 38–42 mm., ♀ 45–50 mm.

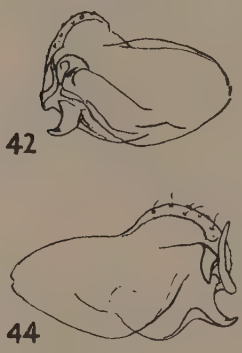
On upper surface wings black, only conspicuous marking a postdiscal bar of 6 white macules ; a red spot, often very inconspicuous, present at anal angle of hind wing in cellule 1*b*. On under surface the same markings appear, but red spot at anal angle of hind wing more constant ; other smaller red spots usually present in cellules 2, 4 and 5, with white lunules along outer margin. A small red mark present at base of fore wing beneath costa.

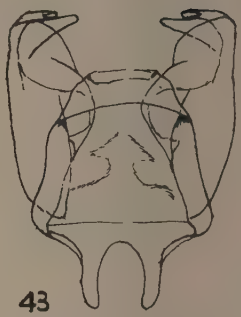
Neuration : cell of fore wing not completely closed.

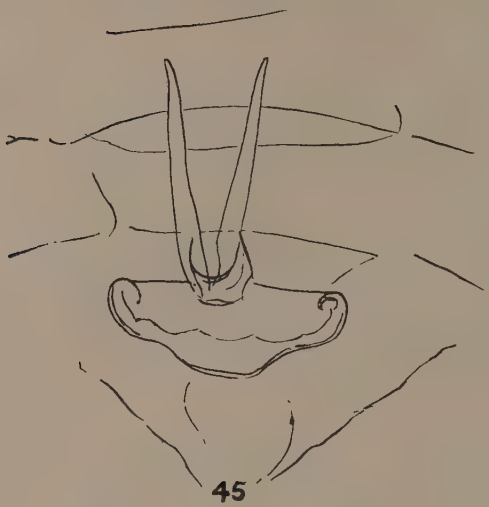
Male genitalia (fig. 41) conform to common type without distinctive features. (Figure 42 shows lateral view of clasp.)

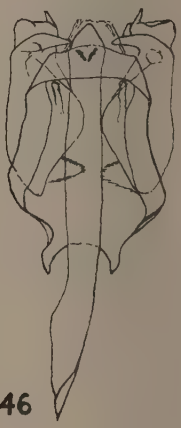
Female genitalia : not examined.

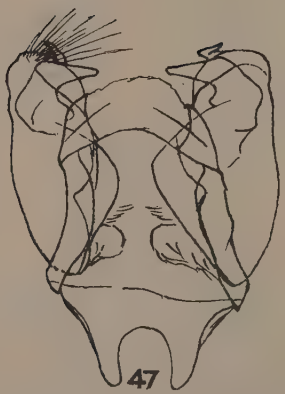
Palpi with white lateral streak.

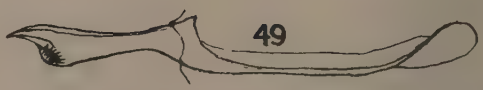












FIGS. 41–49.—(41 and 42) *Chlosyne melanarge :* (41) male genitalia, dorsal view ; (42) the same, lateral view of clasp. (43–45) *C. erodyle :* (43) male genitalia, dorsal view ; (44) the same, lateral view of clasp ; (45) female genitalia. (46) *C. poecile :* male genitalia, dorsal view, penis *in situ*. (47–49) *C. eumeda:* (47) male genitalia, dorsal view ; (48) the same, lateral view of clasp ; (49) penis, lateral view.

Localities.—Mexico : Guerrero ; Rincon ; Amula ; Acaguizotla. Honduras : San Pedro Sula. Nicaragua : Chontales ; Matagalpa. Guatemala : Motagua ; Ysabal ; Tocoy. Salvador : Sonsonata. Costa Rica : Caldera.

Godman and Salvin considered this a very local species, but it is clearly more widely distributed than they knew. The size and markings are very constant.

(9) *Chlosyne erodyle* (Bates)

Synchloe erodyle Bates, 1864, *Ent. mon. Mag.* **1** : 84 Loc. Guatemala (interior).
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 20, figs. 3, 4.
Seitz, Pl. 91*h*.
Holland, *Ed.* **2** : Pl. 59, fig. 17.

Expanse : ♂ 41–42 mm., ♀ 50 mm.

Among the larger species of the genus. On upper surface fore wing marked with small white spots, 2 in cell, followed by strongly curved discal series of 5 or 6 spots, and submarginal series of small white inter-nervular points. On hind wing a large rounded red macule in cellule 1*b* and sometimes a small red spot in cellule 2 ; basal field yellow. On under surface usual red mark present beneath costa at extreme base of fore wing. Female marking resembles male ; no material variation in a long series.

Neuration : upper disco-cellular short, with 6 arising close to 7 ; lower disco-cellular closes about half the cell.

Male genitalia (fig. 43) with wide simple tegumen ; in dorsal view posterior inferior process of clasp too short to be seen ; lateral view of clasp is shown in figure 44.

Female genitalia (fig. 45) : sterigma wide but shallow, with posterior margin clearly defined ; double bacillus long, extending over sternite VII.

Palpi (not figured) of usual type, slightly ascending and marked externally with a white stripe.

Distribution.—This species appears to have a wide distribution in the northern districts of Central America, and occasionally appears in Texas.

Localities.—Mexico : Oaxaca. Guatemala : Polochic Valley ; Tucuru ; Chiacam ; Vera Paz ; Panzos ; Motagna ; Val de Sta. Maria ; Panzas. Honduras : San Pedro Sula. Nicaragua : Chontales ; San Ramon.

(10) *Chlosyne poecile* (C. and R. Felder)

Synchloe poecile C. and R. Felder, 1867, *Reise Novara* **3** : 396. Loc. Bogota—New Granada.
Holotype : B.M. (N.H.).

Figures : Seitz, Pl. 91*g*, under-side of female.

Expanse : ♂ 50–54 mm., ♀ 51–54 mm.

A larger insect than *erodyle*. On upper surface fore wings show rather large rounded yellow spots, 2 in cell, one below cell, and a discal series of 5, of which lowest one below cell is largest ; usual submarginal series of small white spots. On hind wings 4 large red inter-nervular spots in submarginal area, arranged in pairs and divided by a small white spot in cellule 3.

Neuration : in all specimens examined discoidal cell completely closed by well-developed disco-cellular nervure.

Male genitalia (fig. 46) resemble those of *erodyle* (Bates).

Female genitalia : not examined.

Localities.—Colombia : Buenaventura ; North Colombia ; Manaure ; Sta. Maria ; Valdevia ; Bogota. Many specimens without complete data. Panama : No further data. Venezuela. No further data.

There is a series in the Hall collection, all from Panama and Colombia, without complete data.

This form is separated from *erodyle* as a distinct specific unit on the presence of the more complete lower disco-cellular nervure in the fore wings, so that the cell appears closed, while in *erodyle* the nervure closes only the lower part of the cell. The forms are certainly closely allied, and may be better placed as subspecies, since it does not appear that they occur in the same countries.

(*a*) form *rubrigutta* Rober

Chlosyne poecile rubrigutta Rober, 1914, Seitz : 452. Loc. Colombia and Costa Rica.
Holotype : probably at Dresden.

Figures : B.C.A., Pl. 20, figs. 1, 2.
Seitz, Pl. 91*g* (♂).

Expanse : ♂ 37–42 mm., ♀ 45–48 mm.
In this smaller form yellow macules on upper surface of fore wing of paler tone but remaining relatively large ; on hind wings a red macule at anal angle in cellule 1*b* but otherwise submarginal area plain black. In all specimens examined cell of fore wing completely closed.

Distribution.—I have only seen this form from the southern districts of Central America.

Localities.—Colombia : Bogota ; Buenaventura. Panama : Chiriqui ; Palobre ; Veraguas. Costa Rica : Asahar de Cartago ; Escaza ; San Mateo.

There is a short series in the Hall collection from Caldera, Costa Rica, taken in August at an altitude of 250 feet. Nominate *poecile* and *rubrigutta* appear to be constant forms, and in the series examined I have not seen any material variation. The distribution areas show some evidence of overlap, and on this account specific distinction might be made, but the material and data concerning habitats are too meagre to allow any definite conclusions.

In four examples from Colombia, without further data, there are traces of additional red spots in the dark submarginal areas of the hind wings.

(11) *Chlosyne eumeda* (Godman and Salvin)

Synchloe eumeda Godman and Salvin, 1894, *Ann. Mag. nat. Hist.* (6) **14** : 96. Loc. Guerrero, Mexico.
Holotype : B.M. (N.H.).
Chlosyne fasciata Rober, 1914, Seitz : 452. Loc. Guerrero, Mexico.
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 108, figs. 1, 2.
Seitz, Pl. 91*g*.

Expanse : ♂ 48–58 mm., ♀ 48–52 mm.
In both sexes on upper surface a strongly marked and rather deep yellow fascia across discal area of both wings. On hind wing 5 red macules in submarginal area are not very close to the outer margin. On under surface a red macule beneath costa at base of fore wing. Upper surface markings are reproduced, but whole discal area and base of hind wing yellow, marked with some small dark streaks and macules.

Neuration : upper disco-cellular nervure in fore wing short and cell only partially closed.

Male genitalia (fig. 47) resemble those of *erodyle* and *poecile :* posterior inferior process of clasp (fig. 48) not appearing in dorsal view ; penis (fig. 49) showing usual generic characters.

Female genitalia : not examined.

Localities.—This species is only represented from Mexico, from Guerrero and Mochitlan.

There is a long series in the B.M. (N.H.) taken by O. T. Baron.

(*a*) form *dryope* (Godman and Salvin)

Synchloe dryope Godman and Salvin, 1894, *Ann. Mag. nat. Hist.* (6) **14** : 96. Loc. Jalisco, Mexico.
Holotype male : B.M.(N.H.).

Figures : B.C.A., Pl. 108, figs. 3, 4.
Seitz, Pl. 91*g* (as *marina*).

Expanse : ♂ 46 mm., ♀ not seen.

Very similar to nominate *eumeda* ; slightly smaller and on upper surface yellow fascia paler in tone ; on hind wings row of red submarginal macules placed more distally and more regularly.

Male genitalia : not examined.

Localities.—Mexico : Magdelena ; Sonora ; Guadelajara (Sept.) ; Oaxaca. There are four male specimens in the collection and each is recorded from a different locality. Two male specimens in the Hall collection are labelled " Western Mexico ". It does not seem likely that *dryope* occurs anywhere as a dominant form, and perhaps it is an occasional variant of *eumeda* which appears in the same localities. There is slight variation in the size of the pale markings. In one male example the base of the hind wing on the upper surface is yellow, with some black macules, and the approach to *melitaeoides* (C. and R. Felder) is so close that I can only regard this example as intermediate. With so few specimens available for study it is not possible to decide finally upon the correct status of this form, but almost certainly it should be placed as *eumeda* showing the first stage of transition towards *melitaeoides*.

Recorded from Rio Iguala and Rio Balsas in Guerrero in May by Brown, 1944, *J.N.Y. ent. Soc.* **52** : 348.

(12) *Chlosyne marina* (Geyer)

Araschnia marina Geyer, 1837, *Zuträge* **5** : 20. Loc. Mexico.
Synchloe hylaeus Godman and Salvin, 1894, *Ann. Mag. nat. Hist.* (6) **14** : 97. Loc. Mexico—Durango.
Holotype : B.M. (N.H.).

Figures : Geyer, *loc. cit.*, No. 877,878 (*marina*).
Seitz, Pl. 91*h* (*marina* not good).
B.C.A., Pl. 108, figs. 7, 8 (*hylaeus*).

Expanse : ♂ 34–38 mm., ♀ 40 mm.

Small species, distinctive features on upper surface are white or yellowish macules forming broken discal fascia on fore wings, but on hind wings fascia very regular and crossed only by black nervures ; in black submarginal field of hind wings large red spots arranged in pairs in cellules 1*b*, 2 and 4, 5 in exactly similar positions to spots in *erodyle* (Bates) and *endeis* (G. and S.) ; base of hind wing black but in some specimens with indications of yellow streaks. On under surface markings definitely yellowish and macules larger ; small marginal lunules appear on both wings.

Neuration : in fore wing upper disco-cellular nervure short ; cell scarcely closed by lower disco-cellular, latter tubular for about half its length.

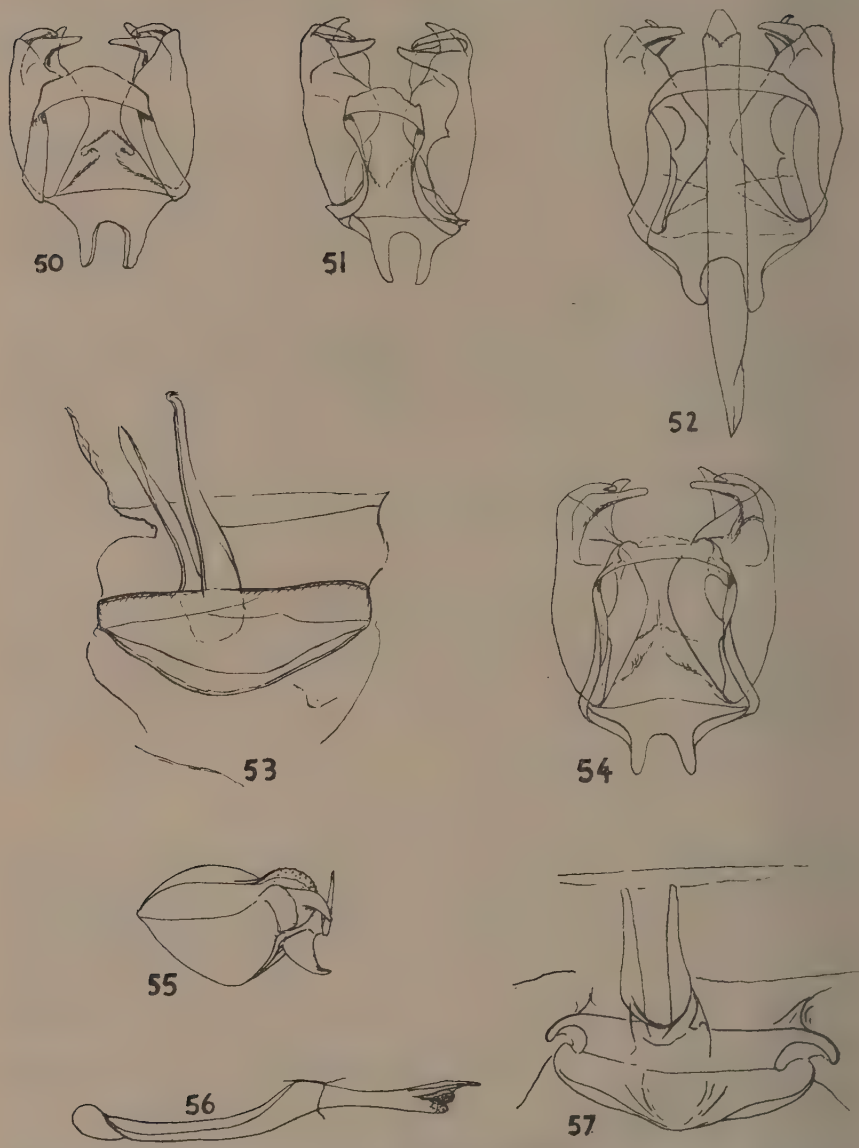
Male genitalia (fig. 50) agree with common type, posterior inferior process of clasp appearing more prominent than in *eumeda*.

Female genitalia : not examined.

Palpi show prominent white lateral streaks.

Localities.—Southern Mexico : Huahuapan ; Oaxaca ; Chilpancingo in open country in July.

There are 7 ♂ and 1 ♀ in the British Museum, 5 ♂ in the Hall collection. The form *hylaeus* was described by Godman and Salvin as a " northern form " of *marina*. In addition to the ♂ and ♀ types there are now 2 ♀ examples in the B.M. (N.H.) and 2 specimens, also ♀, are present in the Hall collection. The specimens are a little larger than nominate *marina* with a wing-expanse of 43–44 mm. and the fore wings rather narrow.



FIGS. 50–57.—(50) *Chlosyne marina :* male genitalia, dorsal view ; (51) *C. endeis ;* male genitalia, dorsal view ; (52–53) *C. definita :* (52) male genitalia, dorsal view ; (53) female genitalia. (54–57) *C. palla :* (54) male genitalia, dorsal view ; (55) lateral view of clasp ; (56) penis, lateral view ; (57) female genitalia.

The only material difference in wing marking is some increase in the size of the pale discal macules on the upper surface of the fore wings, which make a definite fascia in *hylaeus* with the macules continuous near the inner margin. The holotype is figured very accurately by Godman and Salvin ; all examples I have seen have been quite similar and all have been labelled as from Durango, undated.

(*a*) form *melitaeoides* (C. and R. Felder)

Synchloe melitaeoides C. and R. Felder, 1867, *Reise Novara* **3** : 396. Loc. " Mexico ".
Holotype : B.M. (N.H.)

No figure has been published.

Expanse: ♂ 40 mm.

In male on upper surface pale macules on fore wing washed with yellow, remaining discrete, *i.e.* not forming a broken fascia as in *dryope* ; on hind wing basal and discal areas yellow with few dark macules and dark scales along nervures ; 4 red submarginal macules arranged as in *marina* with white dot in cellule 3. On under surface pale yellow macules of fore wings all enlarged, especially basal marks ; on hind wing black macules bordering yellow discal fascia (which form a continuous series in *marina*) broken into small spots, scanty at base, ground colour distinctly yellow.

This form appears to grade into *dryope* and *eumeda* (G. and S.). No female specimen has been seen.

In addition to the holotype there is one other example, without data, in the B.M. (N.H.) collection.

I have no doubt that *eumeda* and *dryope* represent a single specific unit, and that *marina*, *hylaeus* and *melitaeoides* are also variants of a single species. The material at the B.M. (N.H.) really suggests that these insects may well form a remarkable series, of which *marina* and *eumeda* are the extreme forms. There is perhaps a slight inconformity between *dryope* and *melitaeoides* which may indicate a specific distinction, but equally well might mean that the final intermediate form is not available. The male genitalia of *eumeda* and of *marina* do not show any definite distinctive characters, but in these butterflies this cannot be taken as showing specific identity. While *marina* is known to inhabit relatively dry, open country, I should guess from the external features that *eumeda* occurs in a different biotope with more luxuriant vegetation. As far as I can judge from the scanty material at hand, the various forms are stable where they occur and intermediate specimens are certainly rare.

(13) *Chlosyne endeis* (Godman and Salvin)

Synchloe endeis Godman and Salvin, 1894, *Ann. Mag. nat. Hist.* (6) **14** : 97. Loc. Western Mexico—Sierra Madre de Tepic.
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 108, figs. 5, 6.
Holland, *Ed.* 2 : Pl. 76, fig. 17, *a*.

Expanse : ♂ 37–40 mm., ♀ 45–46 mm.

On upper surface both wings marked with white macules and spots on black ground, arranged in pattern very similar to that in *marina* (Geyer) ; small orange stria over disco-cellular nervure of fore wing and on hind wing submarginal spots small and orange (not true red). On under surface markings very distinct and striking, with bright orange macules at wing bases and in submarginal areas.

Neuration : in fore wing upper disco-cellular nervure short, lower well-developed, cell appearing completely closed ; in hind wing cell open.

Male genitalia (fig. 51) (single specimen examined) *:* resemble those in *marina* and many other species ; tegumen unusually narrow but possibly the old dry example distorted and compressed ;

terminal finger-like process directed medially with slight curve upwards. (It is possible that these features will provide characters of specific distinction between *endeis* and *marina*, but confirmation with more preparations will be necessary.)

Female genitalia : Not examined.

Palpi orange-brown above and grey below, without white lateral stripe.

Locality.—A series of 8 ♂ and 1 ♀, including the holotype, are all from the Sierra Madre de Tepic in Western Mexico. The species is not represented in the Hall collection. Recorded from the Eastern slope from Jacala, Hidalgo (July) by Brown, 1944 ; *J.N.Y. Ent. Soc.* **52** : 348.

(*a*) form *pardelina* **forma nov.**

There is a short series of male specimens of *endeis* in the United States Museum, New York, in which the ground-colour is yellow.

Expanse : ♂ 40 mm.

On upper surface wing markings resemble those of typical *endeis*. On fore wings 4 small spots in cell and in 1*b*, and postdiscal macules all yellow, except postdiscal macule in cellule 10 near costa ; spots of submarginal series remain white. On hind wings post-discal fascia yellow ; red submarginal macules enlarged. On under surface of fore wings basal and discal fields orange-yellow and nearly unmarked ; in particular, discal series of black macules not present. On hind wings usual markings present and very brilliant, with basal fascia and submarginal macules bright orange.

Locality.—The specimens are all marked.—La Gloria, S. of Monclova, Coah. Mex., 3300 feet, Aug. 24th, 1947.

The holotype has been returned to the American Museum, New York. The presence of this form is interesting as an example of the close association between the colours white and orange in these butterflies (cf. *C. lacinia crocale* (Edw.)).

(14) *Chlosyne definita* (Aaron)

Melitaea definita Aaron, 1884, *Papilio* **4** : 176. Loc. Southern Texas.
Type : probably at Chicago.
Melitaea albiplaga Aaron, 1884, *Papilio* **4** : 175. Loc. Southern Texas.
Type : not traced.
Melitaea schausi Godman and Salvin, 1901, B.C.A. **2** : 676. Loc. Vera Cruz, Mexico.
Holotype : B.M. (N.H.).
Melitaea beckeri Godman and Salvin, 1901, B.C.A. **2** : 676. Loc. Durango, Mexico.
Holotype : B.M. (N.H.).
Melitaea anastasia Hemming, 1934, *Stylops* **3** : 193 nom. nov. pro. *M. beckeri* Godman and Salvin, 1901, nec *M. artemis* var. *beckeri* Herrich-Schaeffer, 1851,

Figures : Seitz, Pl. 103*c*.
Holland, *Ed.* **2** : Pl. 56, figs. 14, 15.
B.C.A., Pl. 108, figs. 11, 12 (*schausi*).
B.C.A., Pl. 108, figs. 9, 10 (*beckeri*).

Expanse : ♂ 28–30 mm., ♀ 35–38 mm.

Small species ; ground colour on upper surface sandy-red, marked with black fasciae and cross lines in usual pattern. On under surface few markings on fore wings ; on hind wings ground colour pale with fine dark cross lines ; wide reddish fascia near base and large macules of same colour in cellules 1*b*, 2, 4 and 5 in submarginal area.

The form *albiplaga* Aaron, with a wing expanse of 30 mm., named from a single female specimen, is placed by McDunnough as an aberration of *definita* which he accepts as the specific name. The description suggests an insect with extensive areas of black ground colour on both wings with fulvous markings. If this attribution is correct, it is interesting to notice the direction of variation, and the possible approach to *endeis*, in which species the markings on the under surface of the hind wing are almost identical with those of *definita*. McDunnough's action can be taken as a

" first reviser's " selection of *definita* as the specific name, since *albiplaga* has priority by a single page. Examination of the holotype of *schausi* shows a lightly marked specimen of *definita*, and the name will fall as a synonym. The insect named *beckeri* by Godman and Salvin, of which there are two examples (including the holotype) in the B.M. (N.H.) is almost certainly a somewhat luxuriant female of *definita*. The markings on the under surface of the hind wing are heavy and show a close approach to *endeis*. In spite of the great difference in colouring on the upper surface, the correspondence in wing marking is so great that it seems quite probable that *beckeri* and therefore *definita* are dry-season forms of a series that includes *endeis*, and I am tempted to associate these together in a single specific group.

Neuration : in fore wing usual formation with rather short upper disco-cellular nervure ; cell appears completely closed.

Male genitalia (fig. 52) (a single specimen only was avaible for examination) : similar to those of *endeis*, *marina*, etc. with terminal processes of clasps only just visible in dorsal view.

Female genitalia (fig. 53) (single specimen only available for examination) : rather distorted, but formation of sterigma simple, recalling *erodyle* (fig. 45).

Distribution.—The species is restricted to an area which includes Texas, Arizona and northern Mexico. It is represented in the B.M. (N.H.) from the following localities. —Texas : Esper Ranch ; Brownsville. Arizona : One female, without complete data. Mexico : Vera Cruz (*schausi*) ; Durango City.

It is recorded as common in the Chinati Mountains, Texas, at the end of September by Tinkham (1944, *Canad. Ent.* **76** : 12).

(*B*) The **palla** group

This is a group of closely related butterflies and their correct classification sets a difficult problem. The wing pattern is very uniform in all species and it is hard to find clear-cut specific characters. The insects occur at altitudes that vary from the foot-hills of California to high alpine biotopes at 10,000 feet or more. They are distributed over a wide area in colonies from the Sierra Madre mountains to Salmonarm and Mt. McLean in British Columbia, and from the Pacific coast to the Rocky Mountains, where in Colorado and the Dakotas they cross the Continental Divide ; otherwise the group does not appear in the Eastern States. Not the least of the taxonomic difficulties arises from the extensive area of the group's distribution in mountainous country, often difficult of access, with a wide range of climate, and it is scarcely possible at present to assemble a truly representative series. The material available in London is very deficient in several respects, and I have attempted only to distinguish clearly the specific units that occur. The following arrangement therefore is only provisional and will certainly need correction with further knowledge.

It is only to be expected with such a wide geographical range, including different biotopes and different climates, that local forms should appear with change of facies that confuse still more the uncertain specific distinctions. In two or three species good specific characters are present in the genitalia of one or other sex, but unfortunately these organs are of less value in this series than they are in many groups. The most valuable specific characters are to be found, I think, in slight differences in the length and disposal of the terminal process of the male clasper, but interpretation is not always easy. It appears that these processes are flexible and may lie almost flat and adducted ; in other cases in dorsal view the backwards twist becomes quite obvious (see *C. gabbii*, figs. 66, 67). Other useful characters appear in the size and shape of the " auricles " of the female genital shield. After careful study of many preparations I have come to the following conclusions. I feel confident of recognising the genitalia of *acastus* in both sexes ; the terminal process of the clasp is long in this species and the same formation is seen in *neumoegeni* which should be associated with *acastus* as a subspecies or ecological (desert) form. *C. hoffmanni* is another species with

unmistakable genitalia. The terminal process of the clasp is so small and bends forwards so sharply that it does not appear at all in dorsal view. *C. gabbii* is more difficult, but I think it can be recognised in most cases by the delicacy of the processes of the clasp, and by other features referred to later. The same appearance is seen in *flavula*, which I believe is best placed as a mountain form of *gabbii*. The genitalia of the uncommon species *C. malcolmi* are much like those of *gabbii*, but in this case the external features are so distinctive that I have placed it as an independent unit. The same may be said of *C. damoetas*, but here the female genitalia seem quite distinct, and I think there is every reason to treat this, too, as an independent species. As a rule *C. palla* is not difficult ; the terminal processes of the clasp are stout, and appear crowded and superimposed when viewed from above. I am uncertain about the correct rank of *C. sterope*.

I have not found it possible to identify the species referred to as *Melitaea glacialis* H. Skinner, 1921, *Ent. News* **32** : 89. Loc. Glacier National Park. The holotype is said to be in the collection of the Academy of Natural Sciences, Philadelphia.

In this way I believe it is convenient to recognise six species of these butterflies, with two or perhaps three well marked ecological (climatic) or subspecific (geographical) forms. Several features of this group call for comment. It is noticeable that races inhabiting dry near-desert areas show on the upper surface a pale sandy ground colour, while on the under surface the pale areas of the hind wings are white or silvered. The species are sensitive to local conditions on the lines seen in the European *Melitaea* and *Mellicta*, with variation in the intensity of colouring and in the extent of dark suffusion on the upper surface in certain localities. The extent of such variation may be difficult to establish, and when specific characters are equivocal it is hard to decide whether an alteration in facies is to be interpreted as an indication of specific status or not.

In Central and South America these butterflies are represented by members of the *lacinia* group, and the territories of the two are contiguous with surprisingly little overlap. The unusual markings and frequent mimetic modification of the *lacinia* group make a great contrast with the familiar wing pattern presented by *palla* and its allies, so similar to the European *Mellicta athalia*, which is evidently the unaltered ancestral type. On the other hand, in such anatomical characters as neuration, and the shape of the palpi and of the genitalia in both sexes, the evidence of close association of the two groups is unmistakable and clearly no generic distinction can be made. The main features of the life history have been worked out in the species *palla*, *acastus* and *gabbii*, and it appears that two generations are the rule at low altitudes, but at greater elevations only a single brood appears each year. There is, however, one significant distinction from all Palearctic forms, in as much as some American species of this and of allied genera are known to feed upon Composite plants, while no European species is known to do so. The chief food plant of *palla*, however, is *Castelleja*, a member of the Scrophulariaceae, and several European Melitaeine species are known to prefer food-plants belonging to this family.

(15) *Chlosyne palla* (Boisduval)

Melitaea palla Boisduval, 1852, *Ann. Soc. ent. Fr.* (2) **10** : 275. Loc. California.
Type : Probably at Washington.

Figures : Oberthur, *Lép. Comp.*, figs. 2173-4 (♂ and ♀). Lectotype from the Boisduval Collection.
Holland, Pl. 16, figs. 13, 14 (♂) ; Pl. 17, figs. 7, 8 (♀) ; *Ed.* 2 : Pl. 58 figs. 21–22.
Seitz, Pl. 88*d*, a pale form.
Wright, Pl. 36, figs. 15–19.

Expanse : ♂ 32–38 mm., ♀ 40 mm.

In male on upper surface ground colour foxy-red, with black striae and cross lines. On under surface of fore wings pattern incomplete ; on hind wings ground colour creamy-white with fulvous basal, discal and submarginal macular fasciae ; narrow undulating fulvous border present

along outer margins of both wings. White cilia on both surfaces interrupted at nervures by a few black scales. In the typical female black markings on upper surface extended and ground colour pale yellow or cream, sometimes almost white ; submarginal macules and narrow marginal line, fulvous, with striking colour contrast in some specimens.

This description would suit almost any member of the group. The specific features of *palla* are hard to describe, but the following points may be helpful.

1. Size. It is a larger insect than most of its close allies.

2. The ground colour of the hind wings on the under surface is distinctly yellow.

3. The black pattern on the upper surface of the fore wings is rather irregular and in most cases the posterior macule of the postdiscal series is enlarged to make a prominent black spot on the inner margin.

Male genitalia (fig. 54) of usual type and similar to those of *lacinia* and many other species from Central America ; tegumen wide but shallow with little sign of any membranous posterior extension ; in dorsal view of clasp terminal finger-like process not very long, usually appearing with a slight upward curve ; posterior inferior process stout ; all processes appearing crowded when viewed from above ; in lateral view clasp (fig. 55) without any special feature ; penis (fig. 56) with usual generic characters.

Female genitalia (fig. 57) of common type ; in most, sterigma appears compressed from before-backwards ; auricles not large.

Boisduval's specimens probably came from a low-lying locality near the coast in southern California, and the figures given by Oberthur resemble closely a series from the neighbourhood of Berkeley, the male very bright fulvous and the female dark with strong colour contrast. Examples in the B.M. (N.H.) from various localities show slight variation in size, possibly racial, and in the intensity of the colour on the upper surface, but it is hard to estimate the significance of this as many specimens are old. An obvious cline of variation appears in both sexes. The males may be darker or lighter in tone (form *whitneyi* auct.), and the females may be very dark in some localities while in others they appear with the male coloration. Barnes and McDunnough remark (1916, *Contrib. Lep. N. Amer.* **3**) that the very dark females occur in the coastal region of California, while in the interior at altitudes of 2000–3000 feet many females show male coloration, and at high altitudes all females are found with male colours.

Biology (Comstock : 109).—The mature larva is dull black with orange and white dorsal macules and similar macules arranged in lateral stripes. The body is scattered with minute white points and grey spots in which the black spines are placed. The food-plant is *Castelleja breviflora* (*Scrophulariaceae*). The butterfly is found at various altitudes from the low foot-hills near the coast to nearly 10,000 feet in the high mountains, and the flight season varies with the locality. Only a single brood has been recorded.

Distribution.—The species is distributed over a wide area from New Mexico and Southern California, through the Sierra Nevada and Rocky Mountains to southern Canada. It is recorded also from Idaho and Montana, but not from the Canadian Rockies in Alberta, and the Canadian range is restricted to the southern districts of British Columbia. The record by Wright from St. Michaels in Alaska needs confirmation.

Localities.—

California :

Females dark. Sissons (May) ; Calusa Co., Stony Creek ; Knight's Valley ; Berkeley (May) ; San Geronimo (May) ; Sonoma Co. ; Cazadero (May) ; Sta. Clara (May) ; Mt. Hamilton (May) ; Lake Co.

Females not dark. Wahwonga ; " Southern California "; Yosemite (May, 4500 feet).

Sierra Nevada : One female, no further data.
Washington : Some dark females, no precise data.
Oregon : Males only, heavy black markings.
Colorado : " S.W. Colorado (Oslar) ", no further data.
British Columbia : Kootenay River ; Coldstream.

In the Am. Mus. N.H. the species is represented from the following additional localities.—

California : Many localities ; dark females from the coastal districts ; series from Lake Tahoe, Mt. Tullock, Sierra Nevada and others from high levels, females not dark, and specimens often small.
Idaho : Series of rather small specimens from Wallace, a few dark females.
Montana : Series from Alberton, *etc.* Females often slightly dark.
Wyoming : Series from several localities including the Tetons.
Utah : A single male from " Utah ".
Colorado : A long series, males rather small and females not dark ; North Park, Larimer Co.; Virginia Dale ; Steamboat Springs, *etc.*
Nevada : Four males from Glenbrook.
Oregon : A small series, Gold Hill ; Crater Lake (Aug.).
Washington : A small series without good data.
British Columbia : A series, most females not dark : Grindrod ; Penticton ; Salmonarm, *etc.* Dated specimens May/June.

(*a*) form *calydon* (Edwards) (Holland)

Melitaea calydon W. H. Edwards (*in litt.*), *in* Mead, 1875, *Wheeler Report* **5** : 759. Loc. Colorado. *nomen nudum.*
Melitaea calydon, mentioned by Strecker, 1878, *Catalogue of Macrolepidoptera* : 126. *nomen nudum.*
Melitaea calydon, mentioned by Barnes and Benjamin, 1925, *Ent. News* **36** : 119. *nomen nudum.*
Melitaea calydon (Edwards) Holland, 1947, *Ed.* **2** : 125. Loc. Colorado.

Figures : Holland, *Ed.* 2 *:* Pl. 58, figs. 19, 20 (type).
Brown (1957), p. 78.

This is the name usually applied to specimens of *palla* from Colorado. Holland's figure, representing possibly one of the specimens referred to in the *Wheeler Report*, shows a rather small male, and a larger female with male coloration, and in both figures there is a slight tendency to colour contrast on the upper surface. Brown (*loc. cit.*) also figures a female specimen, and he refers to colour contrast as typical of Colorado specimens. There is a short series in the B.M. (N.H.) from " S.W. Colorado " but it is doubtful whether these represent *calydon* as it is generally understood, and I have little knowledge of this form in nature. From the published descriptions it seems probable that it may be placed as a mountain modification, but it is less certain that subspecific rank is valid. I am doubtful if the form is peculiar to Colorado as we have specimens from California which seem to match perfectly with the description and figures.

Distribution.—Brown (1957) gives many localities in Colorado, both western and eastern slopes of the mountains, and suggests the presence of the same form in Wyoming and perhaps also in New Mexico. He records the insect flying in woodland clearings up to an altitude of 9500 feet.

Note.—The authorship of this name needs clarification. It appears first in Mead (*loc. cit.*) without any description as " *Melitaea calydon* W. H. Edwards *in litt.*" This is obviously *nomen nudum*, and the possible type designated by Mead in the Carnegie Museum is not acceptable. It is mentioned by Strecker with the note " *calydon* = some one of the forms of *palla* ", without any description or indication that the author had seen specimens. The name is not included by W. H.

Edwards in his *List* (1884), nor by Skinner in his *Synonymic Catalogue of the North American Rhopalocera* (1898). It is mentioned by Barnes and Benjamin (*loc. cit.*) as a forgotten name, with reference to Mead and Strecker, in the following terms : " we think this is Colorado *palla*, which we do not consider distinct enough from Californian *palla* to warrant designation as a distinct sub-species." Some authorities might consider that these references, although without any formal description, might make the name *calydon* " available ", but it would remain *nomen nudum* and without any practical value. In my opinion, and Mr. N. D. Riley agrees with this view, the notes by Strecker and by Barnes and Benjamin do not constitute a description or indication within the meaning of the International Rules of Nomenclature, and in consequence the name has no standing from these early references. More recently the form was described as a distinct species and the name validated by Holland (1947) with figures of two specimens standing under this name in the W. H. Edwards collection today, which are designated types. It seems quite doubtful whether the introduction of this name serves any useful purpose.

(*b*) form *whitneyi* auct.

In my opinion the attribution of the name *whitneyi* Behr to a form of *palla* is not entirely satisfactory. The original specimens were taken by members of the State Geological Survey at the headquarters of the Tuolumne River in the " elevated and uninhabited regions ", as Behr put it, in what is now the Yosemite National Park. I have not seen any lightly marked specimens of *palla* from that region, nor do such specimens from other areas correspond altogether with Behr's description " the reticulate black marking runs in much thinner lines and is more regular than in *palla* ". The black markings in strongly modified specimens of *palla* may be partially obsolete, and cannot truly be termed " more regular ". On the other hand the description seems very appropriate for *malcolmi* Comstock, which is well known to occur near the Tioga Pass in the type locality for *whitneyi*. I can scarcely believe that Behr in 1863 would describe as a new species such a slightly modified form as that illustrated by Holland, Pl. 17, figs. 7, 8, under the name *whitneyi*. In fact the present interpretation of the identity of this form seems somewhat uncertain and the background is as follows. Behr's collection was destroyed in the great earthquake and fire at San Francisco but some of his material found its way into Strecker's collection and this is now preserved in the Chicago Natural History Museum. This collection contains three specimens reputedly " types " of *whitneyi*, labelled as from Utah, which were examined by Barnes and Benjamin (unpublished notes) who referred them all to *C. acastus* and rejected their claim to be accepted as " types " of *whitneyi*. Another specimen in the W. H Edwards collection at Pittsburgh is also claimed to be the type of *whitneyi*. This specimen carries a label " *whitneyi* Behr-type " written in ink (? by Behr) and a printed locality label " Sier. Nev. Cal." It seems strange that this single example of Behr's types should find its way into the W. H. Edwards collection. The existing data do not identify it as a specimen taken during the Geological Survey and I do not feel that its *bona fides* can be accepted without reserve. For the time being it seems sensible to employ the name *whitneyi* in the present generally accepted interpretation, but the traditional basis for this attribution should be recognised.

Melitaea whitneyi W. H. Edwards, 1884, *List. Diurn. Lepidopt.*, et auct.
? *Melitaea whitneyi* H. Behr, 1863, *Proc. Calif. Acad. nat. Sci.* 3 : 88. Loc. California.

Figure : Comstock, Pl. 36, fig. 13 (♂).

Name commonly applied to form of *C. palla* in which ground colour on upper surface rather pale orange-red with marked reduction of normal black markings ; on under surface markings less strongly developed and of paler tone. Females show male coloration.

As far as our rather poor material indicates, such specimens are met with in various localities, and especially at considerable altitudes in the Sierra Nevada. They represent the extreme " dry " form in the standard cline of variation.

Localities.—California : Summit, " Sierra Nevada ". Utah : " Utah ", without further data. Colorado : " S.W. Colorado " (Oslar).

(*c*) Named occasional forms

(i) *blackmorei.* *Melitaea palla* ab. *blackmorei* Gunder, 1926, *Ent. News* **37** : 5 (fig.) Loc. Lake Lytton, British Columbia.

(ii) *abnorma.* *Melitaea abnorma* Wright, 1905, *Butt. West Coast* : 160 (fig.). Loc. Truckee, California. The usual black discal macules are lacking, and the pattern is quite bizarre. Referred doubtfully to *palla.*

(iii) *eremita.* *Melitaea palla eremita* Wright, 1905, *Ibid* : 157 (fig.). A very dark female with pale cream ground colour.

(iv) *hemifusa.* *Melitaea palla* ab. *hemifusa* Gunder, 1930, *Ent. News* **41** : 17 (fig.).

(v) *stygiana.* *Melitaea palla* ab. *stygiana* Comstock, 1925, *Bull. S. Calif. Acad. Sci.* **25** : 32 (fig.). Loc. Willow Ranch, Modoc Co., California. A melanic female darker than *eremita* Wright.

(vi) *wardi.* *Melitaea palla* ab. *wardi* Oberthur, 1914, *Lép. Comp.* : 79 (fig.); and Comstock, Pl. 27, fig. 2. A male aberration corresponding to *molpadia* Oberthur of *M. parthenoides* Keferstein.

(vii) *vanduzeei.* *Melitaea palla whitneyi* form *vanduzeei* Gunder, 1928, *Canad. Ent.* **60** : 165 (fig.). Loc. Portola, California. A very melanic specimen.

(16) *Chlosyne acastus* (W. H. Edwards)

Melitaea acastus W. H. Edwards, 1874, *Trans. Amer. ent. Soc.* **5** : **16.** Loc. S. Utah.
Type ♂ : Carnegie Mus. Pittsburgh.

Figures : Comstock, Pl. **37, figs. 7, 8, 9.**
Holland, Pl. **16, figs. 11, 12 ;** *Ed.* **2 :** Pl. **58, fig. 27** ♂ **(not type).**

Expanse : ♂ **32–35 mm.,** ♀ **37–40 mm.**

In male ground colour on upper surface uniform sandy-orange ; usual pattern of black cross lines and striae present, with all markings fine and regular ; on under surface of hind wing and at apex of fore wing pale macules filled with shining white.

Male genitalia (fig. 58) with good specific characters ; tegumen usually a little deeper than in *palla* with a conical membranous posterior extension ; harpe stout and terminal process of clasp very long (fig. 59), curved forwards and inwards towards tegumen ; penis with usual generic features. Figure 61 shows thin juxta with straight posterior edge.

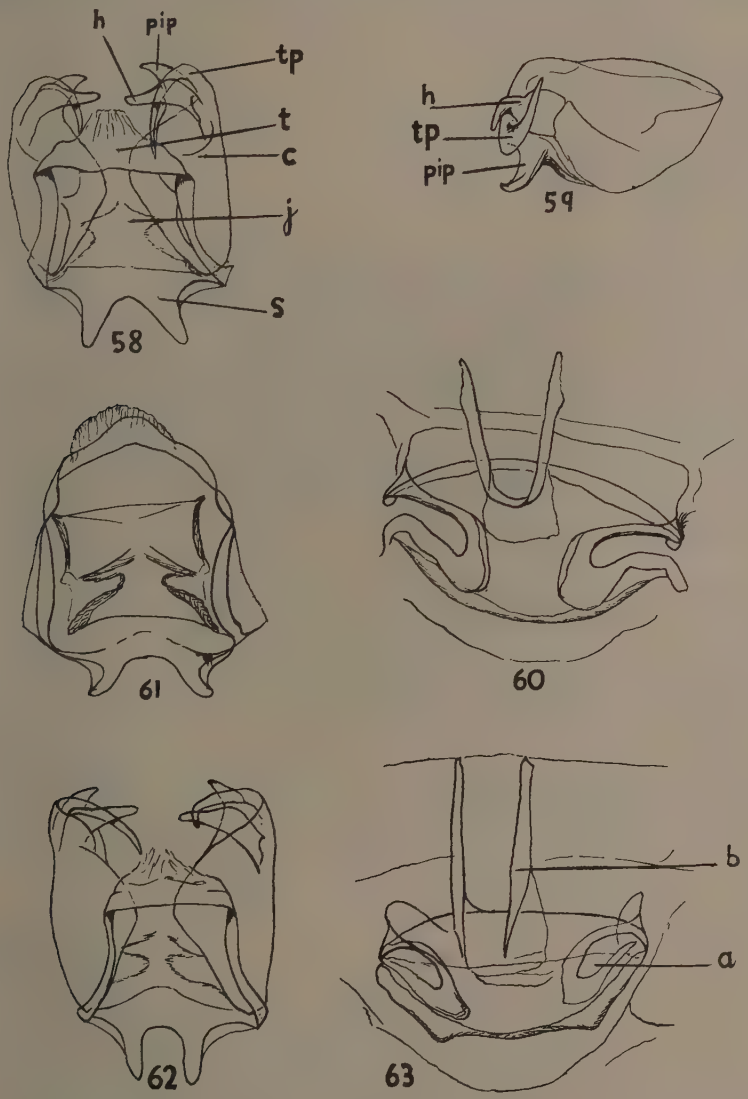
Female genitalia (fig. 60) closely resembles those of *palla* but are distinct in large size of auricles.

This insect looks very much like a pale " dry-season " form of *palla*, and the two species are easily confused. In series the black pattern on the upper surface is less regular in *palla*, and in particular there is often a solid square black macule on the inner margin of the fore-wing in *palla* which is not so obvious in *acastus*. There is a single male specimen in the W. H. Edwards collection at Pittsburgh, with Edwards' " type " label, which may be regarded as the type of this species. This specimen is not figured by Holland.

Distribution.—It is evident that the distribution of this species is more extensive than is usually supposed. There is little variation in external features in the different populations. Specimens in the collection from New Mexico show a rather intense tone of orange ground colour and those from Alberta are slightly darker and more subdued.

Localities.—Utah : Stockton (Spalding) ; Beaver Co.; South Creek. Arizona : Fort Grant. New Mexico : Jamez Springs (a single pair). Colorado : " S.W. Colorado " (Oslar) ; Glenwood Springs (Oslar–June). Nevada : Two males without further data. Montana : A single pair without further data. California : Sonoma Co. ; " California ", several specimens without more data. North Dakota : Dunn Co. ; Billings Co. (Puckering). Alberta : Carbon ; Dorothy (1 male only).

Specimens have been dissected from California, Utah, Colorado, N. Dakota and Alberta.



Figs. 58–63.—*Chlosyne acastus :* (58) male genitalia, dorsal view ; (59) lateral view of clasp ; (60) female genitalia ; (61) male genitalia, clasps removed to show juxta ; (62) *neumoegeni*, male genitalia, dorsal view ; (63) the same, female genitalia. *a*, auricle ; *b*, bacilli ; *c*, clasp ; *h*, harpe (clasper) ; *j*, juxta ; *pip*, posterior inferior process ; *s*, saccus ; *t*, tegumen ; *tp*, terminal process.

The following additional localities are represented in the Am. Mus. N.H.—Idaho : Springfield. Arizona : Sedona ; Grand Canyon. Utah : Mesa Co. ; Eureka ; Dividend. Nevada : White Pine Co.; Charleston Mts. California : Mono Co. ; Sierra Nevada ; Mojave Desert (April, near *neumoegeni*).

Other described form

pearlae. *Melitaea acastus* ab. *pearlae* Gunder, 1926, *Ent. News* **37** : 5. Loc. Mono Co., California. An abnormal example with pale fore wings and dark hind wings, equivalent to the form *corythallia* Huebner.

(*a*) *acastus neumoegeni* (Skinner)

Melitaea neumoegeni Skinner, 1895, *Ent. News* **6** : 113. Loc. Utah.
Type : Acad. Nat. Sci. Philadelphia.

Figures : Comstock, Pl. 35, figs. 13, 14, 15.
Holland, *Ed.* 2, Pl. 56, fig. 16 (paratype ?).

Expanse : ♂ 34–37 mm., ♀ 39–44 mm.

In male on upper surface ground colour very bright sandy-orange or brick-red ; on fore wings markings on proximal half scarcely indicated, black discal macules usually forming a complete series, only costal bar well developed, post-discal series represented by a costal macule, marginal lunules prominent, each enclosed by dark scales ; on hind wings disc beyond cell mostly free from any pattern, series of black-bordered marginal lunules forming most conspicuous marking. On under surface all usual markings present with pale areas on hind wings and at tips of fore wings filled with brilliant white scales which shine with a silky reflection ; contrast with orange macules and fasciae most striking.

Female larger and in most specimens black markings on upper surface are more complete.

Male genitalia (fig. 62) resemble those of typical *acastus*, clasp with long terminal process bent forwards under harpe.

Female genitalia (fig. 63) with same structure as in nominate *acastus*, with large auricles.

Biology. (Comstock, 1923, *Bull. S. Calif. Acad. Sci.* **22** : 69.)—The larva is black, sprinkled with grey dots which extend to make an indistinct lateral line. There are nine rows of jet-black spines. The food-plant is *Aster tortifolius*. In the Colorado deserts the insect appears in March and again in September. All dated examples that I have seen have belonged to the first brood.

Distribution.—The Californian deserts appear as the headquarters of *neumoegeni*. All specimens that I have seen from Utah are certainly best placed as *acastus*, although *neumoegeni* was described from that State. Both forms, with intermediates, have been seen from Nevada and from Arizona.

Localities.—California : Kern Co. ; Mariposa ; St. Barbara Co. ; Inyo Co. ; Little Rock ; San Bernadina ; San Diego, *etc.* Arizona : Goldrod (1 male only). Nevada : Mt. Wheeler ; Charleston.

Other described forms

(i) *fridayi.* *Melitaea neumoegeni* Skinner tr. f. *fridayi* Gunder, 1932, *Canad. Ent.* **64** : 283. Loc. Los Angeles Co., California. A female with the ground colour on the upper surface " cream-buff ".

(ii) *boharti.* *Melitaea neumoegeni* form *boharti* Gunder, 1933, *Ibid.* **65** : 173. Loc. Los Angeles Co., California. A male with a conspicuous and complete row of large oval macules across the discal area on the under surface of the hind wings. This is the aberration *subtus-ocellata* of Reverdin, recorded in *Melitaea diamina* Lang and in *Mellicta parthenoides* Kerferstein, among European species.

(17) *Chlosyne damoetas* (Skinner)

Melitaea damoetas Skinner, 1902, *Ent. News* **13** : 304. Loc. Colorado, South Park, Hall Valley, Williams River Range.
Type : Acad. Nat. Sci. Philadelphia.

Figures : Holland, *Ed.* 2, Pl. 56, fig. 13 (fair).
Brown (1957) : 77.

Expanse : ♂ 30–34 mm., ♀ 38–40 mm.

In male on upper surface ground colour rather pale, dull orange-yellow ; usual black pattern present, not heavily marked but with a tendency to fuscous suffusion, especially at wing bases, giving overall dusky appearance quite unlike any other member of the group. On under surface of fore wings black discal fascia of small macules prominent, especially costal bar, with a well-defined black fascia forming internal border of marginal lunules ; on hind wings ground colour very pale, with usual bands of orange macules. (Only old specimens are available for making this description.)

Male genitalia (fig. 64) with rather slender terminal processes, longer than usual, turned back under harpe in one example. There is a likeness to genitalia of *gabbii* but specific features not well marked.

Female genitalia (fig. 65) (one preparation) more distinctive in the unusually small auricles.

It is not difficult to recognise this species, which shows a dusky appearance that is quite distinctive. There is no reason to suppose that *damoetas* is a high level representative of another species, and the genitalia of both sexes confirm its rank as an independent species.

Distribution.—The insect is recorded most often from the Rocky Mountains of Colorado, with occasional records from Wyoming and southern British Columbia. It is probably more widely distributed on the highest mountains than the records indicate. In Colorado the butterfly behaves as a true alpine species. It is found only above the tree line (Brown, 1957) at altitudes of 10,000 feet or more, while in British Columbia it is recorded from 8000 feet. It is considered a rare species, possibly because the flight places are difficult to reach.

Localities.—Colorado : South Park ; Rico ; San Miguel Co. ; Yellow Mt. (12,000 feet, August).

In the collection at the Am. Mus. N.H. there are specimens from other localities in Colorado : Boulder Co. ; Pitkin Co. Wyoming : Chasm Lake ; Teton Mts.; Sublette Co.

There are two male specimens in the Blackmore Collection at Vancouver City, taken at 8000 feet on Mt. McLean (near Seton Lake), August 2nd and July 28th.

Other described form

damoetella. *Melitaea damoetas* ab. *damoetella* McDunnough, 1927, *Canad. Ent.* **59** : 160. Loc. Seton Lake (Mt. McLean), British Columbia. A female aberration greatly suffused with black.

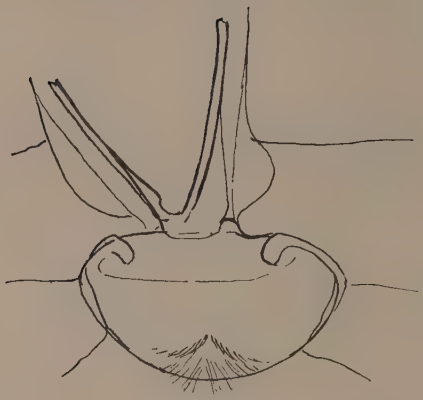
(18) *Chlosyne gabbii* (Behr).

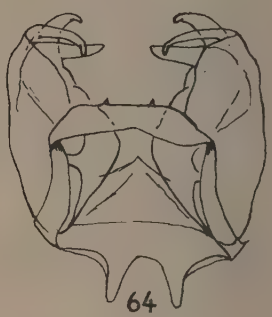
Melitaea gabbii Behr, 1863, *Proc. Calif. Acad. Nat. Sci.* **3** : 89. Loc. Mountains near Los Angeles.
Type : probably lost.
Melitaea sonorae Boisduval, 1869, *Ann. Soc. ent. Belge*, **12** : 56. Loc. Sonora.
Type : probably at Washington.

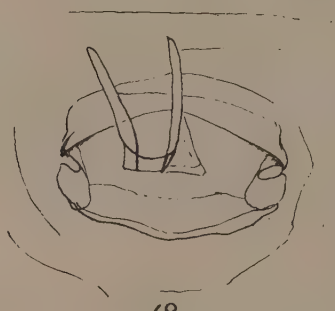
Figures : Holland, Pl. 16, fig. 15 ; *Ed.* 2 : Pl. 58, figs. 16, 17.
Wright, Pl. 19, fig. 174 ♂ ; (? fig. 174*b* not *gabbii*).
Comstock, Pl. 36, figs. 1, 2 ♂ (? fig. 3 ♀ not *gabbii*).
Seitz, Pl. 88*e* (poor figure).
Oberthur, *Lép. Comp.*, figs. 2189, 2190 (*sonorae* Boisduval).

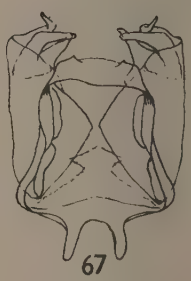
Expanse : ♂ 28–34 mm., ♀ 35–38 mm.

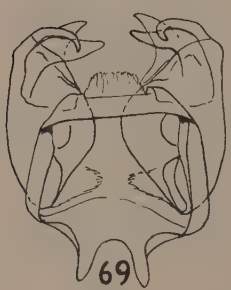
In male on upper surface this species resembles rather closely a small specimen of *palla*, with especially delicate and complete markings ; on under surface basal and discal fasciae and marginal lunules of hind wing filled with brilliant, shining white. Female slightly larger

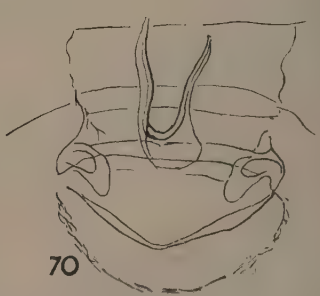












FIGS. 64–70.—(64 and 65) *Chlosyne damoetas :* (64) male genitalia, dorsal view ; (65) female genitalia. (66–68) *C. gabbii:* (66) male genitalia, dorsal view (Idaho) ; (67) the same (Utah) ; (68) female genitalia. (69 and 70) *C. gabbii flavula :* (69) male genitalia ; (70) female genitalia.

as a rule. On upper surface of fore wings discal fascia, one macule in cell and another below this yellow; wing-base, post-discal and submarginal macules orange-red, partly shaded with yellow; on hind wing discal fascia yellow, postdiscal macules orange-red and submarginal lunules rather paler orange, giving general bright colour contrast. On under surface silvery macules very brilliant.

Male genitalia (fig. 66) small in comparison with *palla*; some variation but as a rule tegumen deeper in *gabbii*; in dorsal view terminal process of clasp rather long and directed medially, transversely; all processes clearly visible, not crowded and superimposed as in *palla*. In some preparations a slight tilt will show the tip of the terminal process turned upwards and backwards (fig. 67). No special feature in lateral view of clasp (not figured); penis with usual generic characters.

Female genitalia (fig. 68) resemble those of *palla*, with well-define sterigma and small auricles.

Variation in both sexes is not marked and consists chiefly in heavier or lighter emphasis of the black pattern on the upper surface. In some male specimens there is a hint of colour contrast of the type that appears in the females, and I have not seen any female without marked colour contrast, which makes me doubtful of the species shown in Comstock's figure 3. While distinction from *palla* should not be difficult, confusion with *acastus* is very possible. In both these species the macules on the under surface are silvered, but on the upper surface the ground-colour is more even in *acastus*, without any tendency to contrast in alternate fasciae, the black pattern is often less regular and the whole insect larger.

Biology. (Comstock, 1931, *Bull. S. Calif. Acad. Sci.* **30** : 15, 89.)—The larva is black with grey tubercles and glistening black spines. There is a narrow yellowish stripe above and below the stigmata. The larvae are gregarious upon *Corethrogyne filaginifolia* Nutt. var. *bernadina* Hall and *Hazardia squarrosa* Greene, both Compositae. Comstock speaks of the occasional emergence of a second generation. All dated specimens that I have seen have been taken in the spring or early summer.

Note.—Two specimens in the Strecker Collection in the Chicago Natural History Museum are marked as " types " of *gabbii*, but the locality of these is given as Sta. Barbara and Barnes and Benjamin (*in litt.*) rejected their *bona fides*.

Distribution.—This species, which is well represented in the collection, has an extensive distribution in the Western States from New Mexico and Arizona northwards through the area of the Great Basin. Specimens are present from the following localities.—New Mexico : Cherry Creek (April). Colorado : " S.W. Colorado " (Oslar). Utah : Two examples collected by Lorquin without further data. California: Sta. Monica (March); Balboa (April); Los Angeles (April/May); Mt. Wilson; Sierra Madre; Laguna Mt.; San Gorgio Pass, *etc.* Nevada : " Nord Nevada " *ex* coll. Oberthur.

The species is represented in the Am. Mus. N.H. from the following additional localities.—Arizona : a long series without precise data. N. Dakota : McKenzie Co.; North Park; these specimens might be better placed as *acastus*. I did not have an opportunity of examining the genitalia. Brown (1944, *J. N.Y. ent. Soc.* **52** : 348) reports 2 specimens near *gabbii* from Mexico : Cumbres 8000 feet, Vera Cruz and Rio Balsas 2400 feet, Guerrero (May).

(*a*) *gabbii flavula* (Barnes and McDunnough)

Melitaea flavula Barnes and McDunnough, 1918, *Contrib. Lep. N. Amer.* **4** : 73. Loc. Colorado.
Type : Nat. Mus. Washington.

Figures : Holland, *Ed.* 2, Pl. 56, fig. 25 (♂, good).
Brown (1957), page 79 (♂).

Expanse : ♂ 31–35 mm., ♀ 34–38 mm.

On upper surface in male colours rather variable, but often paler and more variegated than in *palla*, differing little from typical *gabbii*. Many examples show distinct yellow tints in marginal lunules and in discal area of hind wing, with clear orange macules in cell of fore wing and

submarginal macules of hind wing. In some examples black markings reduced but discal series often heavy, especially black mark on inner margin of fore wing. On under surface predominant pale yellow tone of all markings quite marked ; small yellow eyespots sometimes ringed with black scales often present in orange submarginal macules, in many specimens visible also on the upper surface. In series there is considerable variation and specimens with more uniform coloration are not uncommon. As a rule female larger and contrast of colours emphasised ; black pattern on upper surface may be reduced in the discal areas, but more heavily marked along outer margins.

Male genitalia (fig. 69) and female genitalia (fig. 70) similar to those of *gabbii*.

Distribution.—There is so much confusion over the determination of *flavula* that it is not possible to guess the effective range of the insect.

Localities.—Colorado : Aspen (June) ; Salida (July) ; Glenwood Springs (June) ; Grand Junction (July).

In the Am. Mus. N.H. the species is represented from various localities in Colorado and in addition from the following.—Utah : S.E. of Salt Lake. Wyoming : 5 examples of a dark form are doubtfully referred here (*see* under *sterope* Edwards). California : a single pair marked " Havelar ".

Brown (1957) has expressed doubt about the reference to Hall Valley in the original description, since this is east of the Continental Divide. He specifies Glenwood Springs as the locality of the type.

When originally described, the authors were uncertain whether *flavula* should be placed as a distinct species or as a form of *palla*. I am sure the last suggestion can be discarded. True *palla* also occurs in Colorado, and it is difficult to believe that two subspecies of the same butterfly can occur in the same territory. A biological distinction is recorded by Brown (1957), who says that *palla* (form *calydon*) inhabits woodland clearings up to 9000 feet altitude, while *flavula* flies only in scrub on the open hillsides and is restricted probably to the west of the Continental Divide. Again, *flavula* appears sufficiently distinct in external characters. On the other hand, there is clearly a closer approach to *gabbii* than to any other species, and this is endorsed by the characters of the male genitalia. The only material difference in pattern is the presence in *gabbii* of silver-white macules on the under surface of the hind wing, which are replaced by pale yellow in *flavula*, and this type of modification may well have an ecological or subspecific basis. If this view is not correct I feel there can be no alternative to giving *flavula* specific rank.

(*b*) Other described forms

(i) *newcombi*. *Melitaea gabbii* ab. *newcombi* Comstock, 1926, *Bull. S. Calif. Acad. Sci.* **25** : 32. A female specimen with normal pattern but exceptionally bright colour contrast.

(ii) *gunderi*. *Melitaea gabbii* ab. *gunderi* Comstock, 1926, *Ibid.* **25** : 32. The normal pattern is partly obscured by extension and suffusion of the black markings.

(iii) *pasadenae*. *Melitaea gabbii* ab. *pasadenae* Gunder, 1924, *Ent. News* **35** : 155. Loc. Pasadena, California. The ground colour on the upper surface is cream-white instead of orange-brown.

(19) *Chlosyne sterope* (W. H. Edwards) forma incognita

Melitaea sterope W. H. Edwards, 1870, *Trans. Amer. ent. Soc.* **3** : 190. Loc. Oregon.
Type : ? Carnegie Museum, Pittsburgh, but *bona fides* uncertain.
Melitaea hewesi Leussler, 1931, *Ent. News* **42** : 12. Loc. Tygh, Oregon.
Type : not traced. Paratype ♂, Carnegie Museum, Pittsburgh.
Melitaea sterope Edwards (= *hewesi* Leussler) Gunder, 1934, *Canad. Ent.* **66** : 130.
Figure : ? Holland, *Ed.* 2, Pl. 58, fig. 23 (not the type).

The description and name *sterope* was based by W. H. Edwards upon a single pair (male and female) from Oregon, without precise data. Both specimens were rather

small for *palla* and on the upper surface of the male the general picture was of white ground colour and extensive black pattern. On the under surface some ochreous colour was present, especially in the cell and at the base of the fore wing. On the hind wing the usual markings were present but all the pale macules were white. In the female the marginal lunules and certain markings in the cell of the fore wings were ochreous, but otherwise the markings resembled the male.

In 1931 a form of *Melitaea* with these characters from Oregon and Washington was described by R. A. Leussler as *Melitaea hewesi*. I have not been able to trace the original pair described by Edwards, but a specimen labelled *sterope* in the Carnegie Museum—possibly labelled by Edwards himself—is said by Dr. Harry Clench to agree very well with three paratypes of *hewesi* in that collection. J. D. Gunder (*loc. cit.*) noticed the similarity of these two descriptions and published a note pointing out the strong probability that *hewesi* was another description of *sterope* ; I feel sure that he was correct in this assumption. The question then is—what is *sterope* Edwards? In the B.M. (N.H.) there are two male specimens, one with the data—Wenatchee, Washington April 26th. 1915 (E. J. Newcomer) and the other—Brewster, Washington, May 10 1939 (O. Bucholz). Both these specimens correspond well with the description of *sterope* and of *hewesi*. In my view they cannot be referred to any form of *palla*, but in size and general appearance a modified form of *gabbii* seems possible and the characters of the genitalia would support this view.

In the absence of suitable material, and especially of the female sex, it is not possible to make any further comment upon the relations of these specimens. Five male specimens from Wyoming in the collection at Am. Mus. (N.H.) referred doubtfully to *gabbii* might be better placed here.

In the collection at the American Museum of Natural History there is a series under the name *sterope* W. H. Edwards, from Okanagan Co. and Brewster, all taken in May, with rather intense colours on the upper surface and very dark females. A small series from Oregon and Washington under the name *hewesi* Leussler looks very similar. I did not have any opportunity of examining the genitalia of these specimens.

Other described form

hopfingeri. *Melitaea sterope* Edwards tr. form *hopfingeri* Gunder, 1934, *Canad. Ent.* **66** : 129. A specimen in which the post-discal brown macules are fused into a series of internervular streaks. Loc. Brewster, Washington. A careful description of the series of *sterope* accompanies this description.

(20) *Chlosyne malcolmi* (Comstock)

Melitaea malcolmi Comstock, 1926, *Bull. S. Calif. Acad. Sci.* **25** : 33. Loc. Mammoth, Mono Co., California.

Type : probably at Los Angeles Museum.

Figures : Comstock, Pl. 36, figs. 10, 11, 12 (fig. 10 = holotype).
Holland, *Ed.* 2, Pl. 58, figs. 25, 26 (♂).

Expanse : ♂ 30–32 mm., ♀ 38 mm.

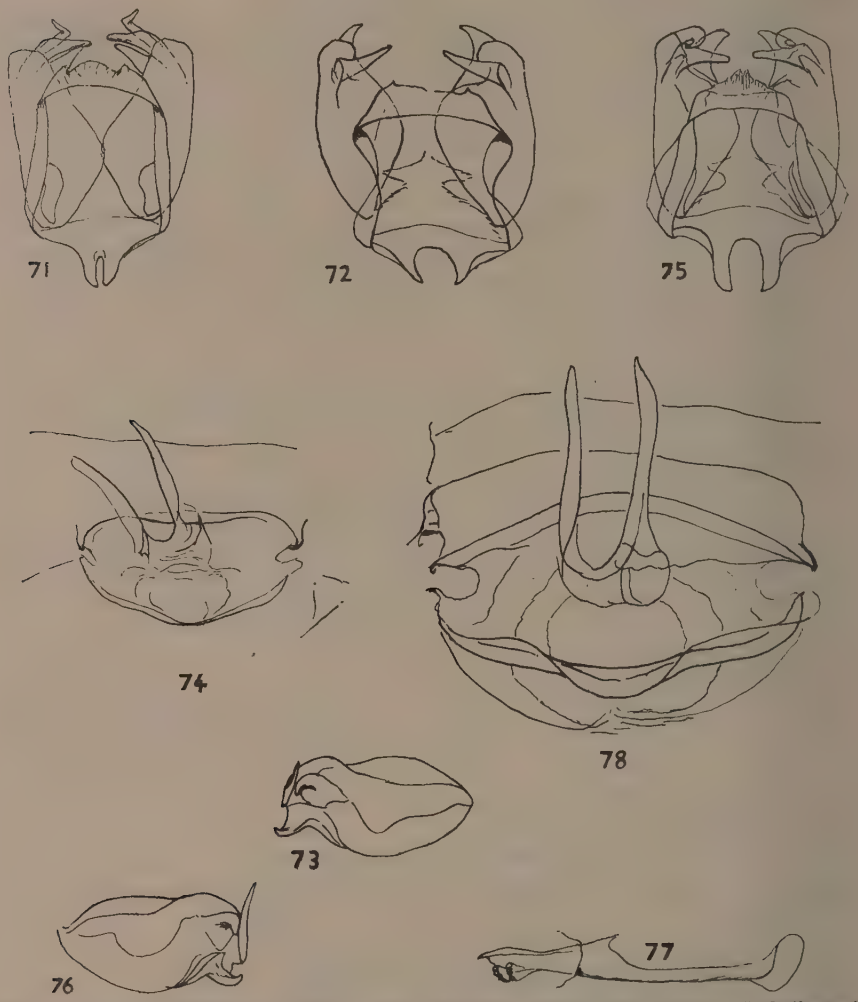
On upper surface in male ground colour bright orange-red and very uniform across both wings ; black transverse lines and fasciae of usual markings exceptionally clear and delicate ; in particular discal and postdiscal series on fore wings even and complete, giving the species a very neat appearance. On under surface usual markings appear, pale macules of hind wing not silvery but pale yellowish-white. In female on upper surface ground colour quite pale yellow with darkened wing bases ; submarginal macules and marginal line orange ; discal macules on hind wing very pale.

Male genitalia (fig. 71) (2 preparations) show marked similarity to those of *gabbii* ; all processes of claspers slender, appearing less crowded than in *palla*, terminal process not so long as in *acastus*.

Female genitalia not examined.

Distribution.—This species seems to be confined to the Sierra Nevada Range. It is definitely a mountain butterfly, found only at altitudes of 10,000 feet or more, and specimens are rare in collections.

Localities.—California: Mono Co.; Tioga Pass; "Yosemite National Park"; Mammoth.



Figs. 71–78.—(71) *Chlosyne malcolmi:* male genitalia, dorsal view. (72–74) *C. hoffmanni:* (72) male genitalia, dorsal view; (73) lateral view of clasp; (74) female genitalia. (75–78) *C. harrisii:* (75) male genitalia, dorsal view; (76) lateral view of clasp; (77) penis, lateral view; (78) female genitalia.

This species, rather smaller than typical *palla*, can be identified by external markings. It has some features in common with *gabbii*, but lacks the silver macules on the under surface of the hind wings. The habitats of the two butterflies are separated by several thousand feet in altitude, and I do not think there can be any question of treating them as subspecific forms of a single unit. The possibility that the name and description of *whitneyi* was applied originally by Behr to a specimen of *malcolmi* has been referred to on page 425.

(21) *Chlosyne hoffmanni* (Behr)

Melitaea hoffmanni Behr, 1863, *Proc. Calif. Acad. Sci.* **3** : 89. Loc. California.
Type : Chicago Natural Hist. Mus.
Melitaea helcita Boisduval, 1869, *Ann. Soc. ent. Belg.* **12** : 55. Loc. California.
Type : probably at Washington.

Figures : Oberthur, *Lép. Comp.*, figs. 2186–7 (*helcita*).
Wright, Pl. 20, fig. 182, *b, c.* ♂ and ♀.
Holland, Pl. 17, fig. 13.
Comstock, Pl. 37, fig. 4 (♀), 5, 6 (♂).
Seitz, Pl. 88*d*.
Barnes and McDunnough, 1918, *Contrib. Lep. N. Amer.* **4** : Pl. 11 figs. 11, 12, ?

Expanse : ♂ 34–35 mm., ♀ 38–40 mm.

Unlike the four preceding species, usually shows a distinctive pattern which makes it easy to recognise. On upper surface ground colour rather pale orange-yellow, seeming paler in worn specimens ; in male heavily marked basal area of fore wing followed by a clear wide field, postdiscal macules and striae commonly present being scarcely developed ; on hind wing markings more complete, but base of wing also heavily marked in contrast with paler distal area. On under surface of fore wing strongly marked black macules of discal fascia with black outlines of marginal lunules together form the most prominent markings ; on hind wing usual pattern of orange fasciae upon a cream coloured ground developed. Female slightly larger than male and as a rule all markings and ground colour of a paler tone.

Male genitalia (fig. 72) show typical features of the group, with an obvious distinctive character : seen in dorsal view harpe and inferior process are visible, but posterior finger-like process cannot be seen ; in lateral view of clasp (fig. 73) process appears very short, not long enough to extend beyond posterior limit of clasp.

Female genitalia (fig. 74) of usual type, with conspicuously small auricles.

Distribution.—The species occurs at a considerable altitude, usually at 5000–6000 feet in mountains. It is likely that the nominate subspecies is restricted to the high mountains of the Sierra Nevada.

Localities.—" California "; " Sierra Nevada "; " Utah " (Lorquin). No further data.

There are examples in the Am. Mus. N.H. from the following additional localities.—California : Fallen Leaf Lake ; Mt. Tallac (? Turlock) ; Gold Lake ; Glacier Point ; Sierra Co., *etc.*

(*a*) form *segregata* (Barnes and McDunnough)

Melitaea hoffmanni segregata Barnes and McDunnough, 1918, *Contrib. Lep. N. Amer.* **4** : 72. Loc. Crater Lake, Oregon.
Holotype : not traced.
Melitaea bridgei Comstock, 1924, *Bull. S. Calif. Acad. Sci.* **23** : 173. Loc. Crater Lake, Oregon.
Holotype : South-West Museum, Los Angeles.

Figures : Barnes and McDunnough, *loc. cit.*, Pl. 11, figs. 8, 9, 10.
Holland, *Ed.* 2, Pl. 58, fig. 28 (♂) ; 29 (♀).
Comstock, Pl. 37, figs. 9, 10 11 (♂ and ♀).

Expanse : ♂ 30–35 mm., ♀ 31–38 mm.

In male on upper surface ground colour of wings bright orange with heavy and intensely black markings, more complete than in typical form ; on fore wing black discal macules prominent, especially large macule on inner margin ; wide black basal area of hind wing enclosing a single pale rounded spot at limit of discoidal cell followed by discal orange fascia, often of a paler tone than submarginal orange macules which tend to orange-red. On under surface in fresh specimen, colours very brilliant ; large black macule on inner margin and black internal border to marginal lunules both prominent on fore wings. In female there is a tendency to variation, ground colour usually paler, especially postdiscal area of fore wing, where there is a noticeable

tendency towards obliteration of the usual black markings. The distinction from typical *hoffmanni* is most obvious in fresh specimens.

Genitalia in both sexes not differing from those of typical form.

I have noticed in the field that the brilliant fulvous ground colour fades to a paler tint in many worn examples, which then approach close to the typical form. The species flies at high sub-alpine levels in mountains. In British Columbia there may be confusion with *C. palla*, which may be dark and heavily marked in northern habitats. In doubtful specimens it may be necessary to check the genitalia in making a definite attribution.

Biology. —The larva of this species has not been identified, but it is very likely that the food plant is *Chrysopsis breweri* at Yosemite, where the butterfly is common.

Distribution.—The form *segregata* is rather unstable, and the specific features appear best developed in the most northerly populations. At Crater Lake, near the northern border of California, some examples are scarcely distinguishable from nominate *hoffmanni*. The development of the *segregata* characters seems to depend to some extent upon ecological conditions.

Localities.—Oregon: Santiam Pass 4500 feet (July); Crater Lake 6–7000 feet (July). In the Am. Mus. N.H. this species is represented from the following additional localities—Washington: A long series without full data, Okanagan Co., Camp Gilbert (July); Brewster (July).

In the Blackmore Collection at Vancouver, B.C., there are specimens from the following Canadian localities.—British Columbia: Greenwood, 3000 feet (June); Barron (July); Kootenay River; Coldstream Ranch; Bonnington Falls.

In some of these specimens the markings on the fore wings are more complete and confusion with *palla* forms is easily made.

(*b*) Named occasional forms

(i) *abnorma*. *Melitaea abnorma* Wright: 160, fig. Loc. Truckee, California. Most of the usual black pattern is suppressed in the post-discal areas. Wright placed this aberrant specimen as *hoffmanni* but I think more probably it is referable to *palla* (q.v.).

(ii) *hollandae*. *Melitaea hoffmanni* form *hollandae* Gunder, 1928, *Canad. Ent.* **60**: 166, fig. Loc. Summit, California. Fig.: Holland, 1947, Pl. 17, fig. 14. Highly melanic with extremely bizarre markings.

(*C*) The **harrisii** group

The three species that compose this group all occur in North America east of the Rocky Mountains. One species (*harrisii*) is peculiar to the Northern and Eastern States and south eastern Canada. The other two have a wider and more southerly distribution, and extend to the south and west to reach New Mexico and Arizona (*nycteis*) and even to Mexico (*gorgone*), but they scarcely invade the territory of the *palla* group and are absent from California and from the States west of the Rocky Mountains. The species, which resemble one another very closely on the upper surface, are recognisable immediately by the distinctive wing pattern which is unlike that of the *palla* series in the wide, orange post-discal fascia of the fore wings, with darkened apex and outer margin which obliterates the narrow orange terminal line. On the hind wings, in the submarginal macules, there is a prominent series of dark white-pupilled rounded spots. The butterflies occur in restricted colonies here and there, and the true extent of their distribution is consequently difficult to determine. The small series in the collection at the B.M. (N.H.) is quite inadequate, and I have copied much information from various text-books on American butterflies.

(22) *Chlosyne harrisii* (Scudder)

Phyciodes harrisii Scudder, 1862, *Proc. Essex Inst.* 3 : 167. Loc. Maine, Massachusetts, New Hampshire.

Figures : Seitz, Pl. 88*e*.
Holland, Pl. 17, figs. 5, 6.
Scudder, Pl. 5, fig. 4.

Chlosyne harrisii was specified by Scudder as the typical species of the genus *Limnaecia*, 1872. The specialized features do not appear to be sufficiently marked to need generic distinction.

Expanse : ♂ 34–35 mm., ♀ 40–42 mm.

On upper surface a typical Melitaeine pattern of black striae and macules on orange-yellow ground ; wide black border along outer margins of both wings and on hind wings a submarginal series of small round black spots with white pupils. On under surface both wings with orange marginal line with large white marginal lunules on hind wings ; basal, discal and submarginal orange fasciae arranged as in *palla* group.

Neuration : in fore wing lower disco-cellular nervure scarcely developed, cell appearing open ; nervure 6 arising very close to 7.

Male genitalia (fig. 75) : in shape of tegumen and claspers (fig. 76) very similar to *palla* and many related species ; penis (fig. 77) in lateral view rather more robust, with distinct double-lobed ostium-folds.

Female genitalia (fig. 78) : sterigma compressed, horizontally oval, with double bacillus of moderate length.

Biology.—According to Scudder the egg is sculptured at the base with pits which become vertical grooves in the upper half, in true Melitaeine fashion. The mature larva is deep reddish-brown with black stripes. It resembles the larva of *Euphydryas phaetona* Drury, with rather long spines. The larvae hibernate in the second or third instar, and they are probably restricted to the Composite plant *Aster umbellatus* as food plant.

Distribution.—The insect occurs very locally in small colonies. The distribution is restricted. It is found in Nova Scotia and in southern Canada as far west as Manitoba, and in the States to the south of this area to West Virginia through Ohio, Indiana, Illinois and Wisconsin (Scudder). Specimens are represented from the following localities.—New York ; New Hampshire ; Massachusetts ; Nova Scotia : No precise data.

The species varies in the degree of development of the dark markings on the upper surface, which may be extended or diminished in a well-marked cline. Variation of this type is common in *Melitaea* and *Mellicta*, and probably has an ecological basis. The extreme forms have been named.

(*a*) form *hanhami* (Fletcher)

Phyciodes hanhami Fletcher, 1904, *Canad. Ent.* 36 : 122. Loc. Manitoba and Minnesota.
Holotype : Nat. Mus. Washington.
Melitaea harrisi albimontana Avinoff, 1930, *Ann. Carneg. Mus.* 19 : 163. Loc. White Mts., New Hampshire and Canada.
Holotype : Carnegie Museum, Pittsburgh.

Figures : Avinoff, *loc. cit.*, Pl. 6 (*albimontana*).
Holland, *Ed.* 2, Pl. 74, figs. 9, 10 (*hanhami* holotype), Pl. 59, fig. 11 (*albimontana* ♂ holotype).
Fletcher, *loc. cit.*

This form differs from typical *harrisii* in the marked reduction of black marking on the upper surface, especially on the hind wings. The insect was described by Fletcher as a new species, and compared with *nycteis* Doubleday. It was correctly associated with

harrisii by Klots (1951). The form *albimontana* Avinoff represents a less extreme modification in the same direction.

Distribution.—Specimens with partial suppression of the usual black pattern appear to occur rather irregularly, most commonly in the northern range, but the general distribution seems more suggestive of an ecological modification than of a geographically defined subspecies.

Localities.—In the B.M. (N.H.) this form is represented by a single pair from Winnipeg.

(*b*) *form liggetti* (Avinoff)

Melitaea harrisi liggetti Avinoff, 1930, *Ann. Carneg. Mus.* **19** : 161. Loc. Pennsylvania : Cook Forest and Slippery Rock.
Holotype : Carnegie Mus., Pittsburgh.

Figures : Avinoff, *loc. cit.*, Pl. 6, figs. 4–7.
Holland, *Ed.* 2, Pl. 59, figs. 12, 13 (♂ holotype, ♀ allotype).
Scudder, Pl. 5, fig. 10 (♀).

This form differs from typical *harrisii* in showing extensive suffusion of the dark pattern on the upper surface, with reduction in the amount of ground colour which is a rather more intense tone of orange. It is represented in the B.M. (N.H.) by three specimens, without data, from the Adams collection. Dr. Harry Clench tells me that this form is widespread in Pennsylvania and quite constant, and in his opinion it constitutes a good regional subspecies.

(23) *Chlosyne gorgone* (Huebner)

Dryas gorgone Huebner, 1810, *Samml. exot. Schmett.* **1** : Pl. 41. Name and figure only.
Melitaea nycteis W. H. Edwards, 1862, *Proc. Acad. nat. Sci. Philad.* **1861** (1862) : 161. Loc. Illinois and Missouri.
Phyciodes carlota Reakirt, 1866, *Proc. ent. Soc. Philad.* **6** : 141. *Nomen novum pro Melitaea nycteis* W. H. Edwards, 1862 nec *Melitaea nycteis* Doubleday, 1848.

Figures : Huebner, *loc. cit.*
Holland, Pl. 17, figs. 24, 25
Seitz, Pl. 89c.
Brown (1957), 82.
Klots (1951), Pl. 8, fig. 5.

Expanse : ♂ 26–33 mm., ♀ 32–42 mm.

Smaller than *harrisii* which it resembles closely on upper surface. Markings generally more clearly defined and on hind wings black spots in orange submarginal fascia very noticeable. On under surface of hind wings an unusual pattern of white macules and sagittate marks on grey ground, making identification easy.

Neuration : upper disco-cellular nervure in fore wing short or very short, cell incompletely closed by the lower nervure, latter tubular for about half its length.

Male genitalia (fig. 79) *:* resemble those of *harrisii* but terminal process of clasp (fig. 80) directed almost horizontally inwards ; penis (not figured) with usual features of genus.

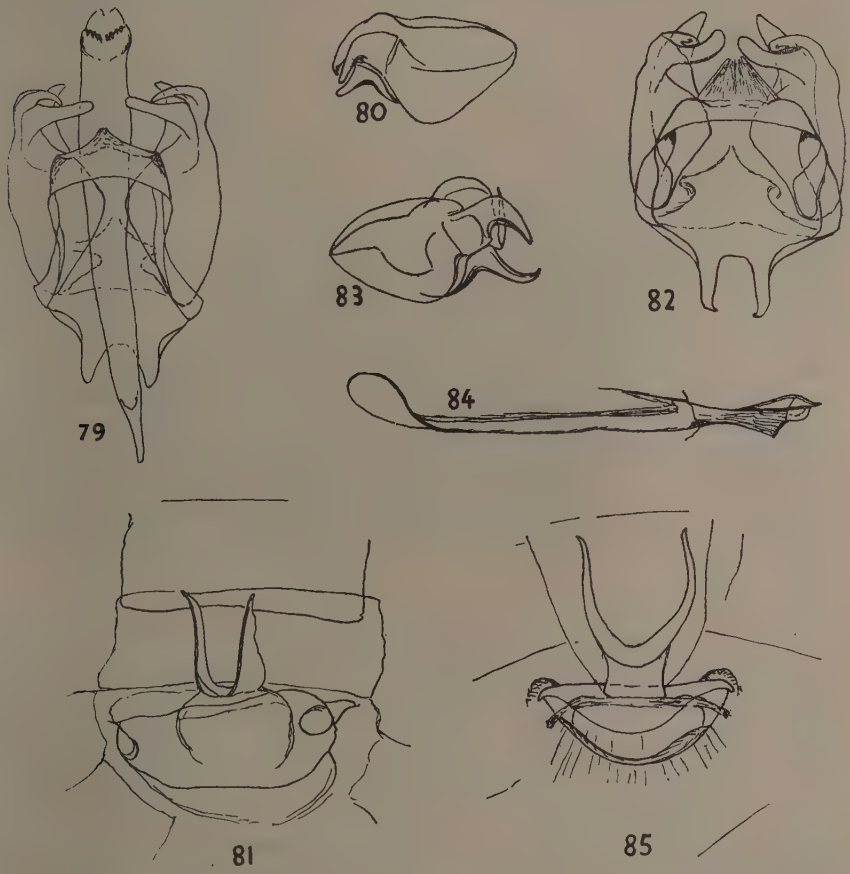
Female genitalia (fig. 81) *:* bifid bacillus shorter than usual and less firmly moulded.

Biology (Dyar, 1893, *Canadian Entomologist* **25** : 93).—The mature larva is brownish red with short, thick spines and shaded black dorsal and sub-dorsal stripes. Strecker 1878 (*Catalogue of Macrolepidoptera* : 123) records *Helianthus trachelifolius* as the principal food-plant. Handford (1933, *Canad. Ent.* **65** : 95) reports a colony found upon *Helianthus scaberrimus* Ell. He confirms that the larva hibernates in the second or third instar.

Distribution.—This species has a wide range northwards from Mexico through the Mississipi Valley to southern Canada and eastwards to Minnesota and Michigan, and also perhaps through the Gulf States (Klots, 1951). It does not appear west of the Rocky Mountains. The butterfly is poorly represented in the B.M. (N.H.), where

there are specimens from the following localities.—COLORADO : a long series from various localities. Specimens, mostly without full data, from TEXAS ; VIRGINIA ; MONTANA ; DAKOTA ; MANITOBA : Brandon ; Miniota (June) ; Cartwright (May) ; NORTH-WEST TERRITORIES : Arcola (July) (5 males).

Brown (1957) states that the range extends northwards to British Columbia. I did not see any specimens in the collections at Vancouver, including the Blackmore collection, during a recent visit, and its occurrence here needs confirmation.



FIGS. 79–85.—(79–81) *Chlosyne gorgone :* (79) male genitalia, dorsal view ; (80) lateral view of clasp ; (81) female genitalia ; (82–85) *C. nycteis :* (82) male genitalia, dorsal view ; (83) lateral view of clasp ; (84) penis, lateral view ; (85) female genitalia.

It is not known from what locality Huebner obtained his original specimen. The figure shows a rather dark modification. It is customary to recognise two subspecies of this butterfly, an eastern form (*gorgone* Huebner) and a western form (*carlota* auct.) with headquarters in Colorado. At the B.M. (N.H.) many specimens are old, and the total series of this species is quite inadequate to show local variation over such a wide distribution area as exists, but I confess that I cannot see evidence of any clear subspecific distinction, perhaps because there are so few examples from the eastern States. On the whole specimens from all localities are unusually constant in colour

and markings for a butterfly that is so widely distributed and that occurs in many different biotopes. The short series from Arcola, N.W. Territories, are all small, with a wing expanse of 29–31 mm., and the tone of the markings is dark, especially on the under surface of the hind wings. Such a difference in examples occurring so far north is probably of ecological significance. The Mathers remarked (1958, *Butt. of Mississipi* : 78) that they were not able to find consistent differences between specimens of *gorgone* from Georgia, Mississipi and Colorado.

The nomenclature of this butterfly has been confused since the name was introduced by Huebner, who figured upon the same plate and, with the same name, the two similar species *Chlosyne gorgone* (figs. 1 and 2) and *Phyciodes phaon* W. H. Edwards (figs. 3 and 4). The name *gorgone* Huebner is clearly restricted to the figures 1 and 2 by Scudder and again by Weymer (1892, *Stett. ent. Zeit.* **53** : 119), which is in accord with modern usage. Another source of confusion has arisen in the use of the name *carlota*, introduced by Reakirt as *nomen novum* for the insect described in 1862 by W. H. Edwards as *Melitaea nycteis* Doubleday. In fact, Edwards made a mistake in identification and the description really applied to *gorgone* Huebner. The mistake was soon recognised by Reakirt who introduced the name *carlota* for the insect wrongly reported as *nycteis* of Doubleday. There was never any description of *carlota* as a new form or species, and the name can only refer to W. H. Edwards' specimens from Illinois and Missouri, which will stand as the typical localities. Since a replacement name must take as its type the type of the name replaced, the so-called types of *carlota* in the Reakirt collection with the locality Colorado, now in the Chicago Natural History Museum, cannot be accepted as such. In the absence of specimens from Illinois and Missouri I cannot say whether it will be correct to accept *carlota* for the high level form of Colorado, or whether, in fact, the name should be used for a different subspecies. Klots (1951) has suggested that nominate *gorgone* occurs only in eastern Georgia, and suggests restricting the name to this race, in which the post-discal saggitate striae on the under surface of the hind wing tend to disappear in the wide dark submarginal fascia, as is shown in the figure by Huebner. He remarks that specimens from this locality are extremely rare.

Note on Melitaea ismeria *Boisduval and Leconte*, 1833

The attribution of this name and figure to *gorgone* is not convincing. The figure is badly drawn and full allowance must be made for inaccuracy in details, but there is one feature that cannot be overlooked. This is the presence on the under surface of a distinct yellow border around the outer margins of both wings, external to the marginal lunules. Among eastern species this feature is best marked in *C. harrisii* (Scudder), and I should be inclined to place *ismeria* as a form of that species near *albimontana* Avinoff. In view of the uncertain application of the name, I have followed the suggestion of Professor A. B. Klots, who treats it as *nomen dubium*. Strecker (1878, *Catalogue of Macrolepidoptera* : 123) states that Boisduval's figure is a copy of an unpublished drawing by John Abbott. If this is the case, it is some evidence that the figure might show a butterfly from Georgia.

Other described forms

nigra. *Phyciodes ismeria* ab. *nigra* Cary, 1901. *Canad. Ent.* **33** : 307. Loc. Nebraska
A heavily melanic and bizarre specimen in which the discal macules on the upper surface are quite lost in the black ground colour.

nox. The insect recorded as *Phyciodes gorgone* form *nox* by Gunder, 1928, *Canad. Ent.* **60** : 167 is referable to the species *Phyciodes phaon* W. H. Edwards.

(24) *Chlosyne nycteis* (Doubleday)

Melitaea nycteis Doubleday, 1847, *Gen. Diurn. Lep.*, Pl. 23, fig. 3 (name and figure).
Holotype : B.M. (N.H.).
Melitaea nycteis Doubleday, 1848, *Gen. Diurn. Lep.* : 181. Loc. U.S.A. (Middle States).
Melitaea oenone Scudder, 1862, *Proc. Essex Inst.* 3 : 166. Loc. Massachusetts, Maine.

Figures : Doubleday, *loc. cit.*
Holland, Pl. 17, figs. 27, 29, 30.
Seitz, Pl. 89*c*.
Scudder, Pl. 5, fig. 6.

Expanse : ♂ 35–38 mm., ♀ 38–40 mm.

In both sexes on upper surface ground colour bright orange-fulvous with black and dark grey markings. Confusion may occur with *harrisii*. Distinctive markings on under surface of hind wings consisting of dark shading along hind margin with a conspicuous pale semilunar macule on hind margin in cellule 3 ; similar macule appears also in *Phyciodes camillus* and other members of *tharos* series with which *nycteis* does not show any structural evidence of near relationship ; no trace of orange marginal line which is present in all forms of *harrisii*.

Neuration : in fore wing upper disco-cellular nervure short, cell is completely closed by the lower nervure, latter tubular in lower third and clearly defined above this ; cell of hind wing completely open.

Male genitalia (fig. 82) : wide tegumen with conical membranous posterior extension ; clasp in lateral view (fig. 83) with long inferior process, in dorsal view harpe and inferior process unusually strong, harpe slightly curved backwards ; penis (fig. 84) with long proximal segment and ostium folds more complicated than usual in this group .

Female genitalia (fig. 85) well defined; firmly chitinised double bacillus appearing as a rigid U-shaped structure ; the auricles not obvious in most preparations. (This structure is slightly unusual in the genus, and shows perhaps greater similarity with *gorgone* Huebner than with any other species.)

Palpi moderately ascending, middle segment somewhat dilated.

Biology.—Very complete information is given by Scudder. The egg is of the usual Melitaeine form with a smooth base and ribs and small pits over the upper two thirds. The full grown larva is black, covered with minute pale spots and with an orange lateral stripe. The variable pupa shows both light and dark colour forms. In the north the larvae emerge in early August, and live in a web for about two months before hibernating in the second (or third?) instar. They live on various Composite plants including *Aster*, *Helianthus*, *Actinomeris*, etc.

Distribution.—According to Scudder the range of this species extends very widely from Quebec to Edmonton in Southern Canada, and southwards through all the American States to North Carolina in the east and to New Mexico and Arizona in the west. It does not appear in California. A distribution map is given by Scudder on Plate 22, fig. 5. It is said to be a commoner species in the central States, *e.g.* Iowa, Kansas, than it is in the east. The species is not well represented in the B.M. (N.H.), where there are specimens from the following localities.—Canada : Manitoba ; Riding Mts. ; Toronto ; Quebec ; St Fabien ; Winnipeg. U.S.A. : specimens, mostly with poor data, from the following States.—New York ; Missouri (St. Louis) ; Pennsylvania (Allegheny) ; Virginia ; Indiana ; Wisconsin ; North Carolina ; Colorado ; Ohio ; Texas ; New Mexico (Sacremento Mts., Cloudcroft, Sapelle Canyon).

There is a well-marked cline of variation, and the extremes of dark and light modifications have been named.

Chlosyne nycteis Doubleday was specified as typical species of the genus *Charidryas* Scudder (1872, *Syst. Rev. Amer. Butt* : 26). The specialised characters do not appear to be sufficiently marked to justify generic separation.

(*a*) form *drusius* (W. H. Edwards)

Phyciodes nycteis var. *drusius* W. H. Edwards, 1884, *Papilio* **4** : 57. Loc. Colorado and Arizona.
Type : Carnegie Museum, Pittsburgh.

Figure : Brown, 1957 : 83.

This form is described very simply: "distinguished by excess of black upon the upper surface. The fulvous is dull, the black pale". Such dark modifications occur at considerable altitudes in the mountains of Colorado, Arizona and Texas, while more typical specimens are common in the lowlands of these districts.

Distribution.—It is difficult to ascertain the effective range of this form. Klots (1951) says it occurs west of the Mississippi River. In the B.M. (N.H.) it is represented by a short series from Colorado, without precise data, and others not quite so dark from North Carolina. There is no doubt that it is most frequent in, if not altogether confined to, the Southern States.

(*b*) form *reversa* (F. H. and R. L. Chermok)

Melitaea nycteis reversa F. H. and R. L. Chermok, 1940, *Canad. Ent.* **72** : 83. Loc. Riding Mts., Manitoba.
Type : not traced.

Described as a racial form in which the black pattern on the upper surface is greatly reduced, while the usual markings on the under surface are less distinct than usual. Equivalent to *harrisii albimontana* Avinoff.

(*c*) Named occasional forms

(i) *milburni*. *Phyciodes nycteis* ab. *milburni* C. Rummel, 1926, *Bull. Brooklyn ent. Soc.* **21** : 203. Loc. Milburn, New Jersey. The wing bases are suffused with black scales, but the normal black border is greatly reduced.

(ii) *lacteus*. *Phyciodes nycteis* form *lacteus* Gunder, 1928, *Canad. Ent.* **60** : 166. Loc. St Louis, Mo. The ground colour is pale cream.

(iii) *greyi*. *Phyciodes nycteis* Doubleday and Hewitson form *greyi* Field, 1934, *Canad. Ent.* **66** : 256. Loc. Lawrence, Kansas. A male specimen heavily suffused with black scales.

(iv) *hewitsoni*. *Phyciodes nycteis drusius* tr. form *hewitsoni* Field, 1936, *J. Ent. Zool.* **28** : 23. Loc. Arizona The ground colour of both wings is very pale, almost white (*cf.* form *lacteus*).

4. **Thessalia** Scudder

Scudder, 1875, *Bull. Buf. Soc. nat. Sci.* **2** : 265. Type species *Melitaea leanira* C. and R. Felder.

Well characterised and compact genus. Species of small or medium size, hind margin of fore wing slightly excavated. In fore wing upper disco-cellular nervure very short or almost absent in some specimens, lower disco-cellular well developed; in hind wing discoidal cell open, or (*leanira*) a vestigial lower disco-cellular nervure present. Male genitalia distinctive, clasp showing 3 processes, terminal process wide at base and directed medially across. (A similar structure appears in the following genus *Texola*.) In female sterigma wide but shallow, and usual bifid bacillus present. Palpi rather long, scarcely ascending. Easily recognisable by peculiar wing pattern.

The taxonomic composition of this small group is somewhat confusing. There are two well-defined species, *leanira* (C. and R. Felder) and *theona* (Ménétriés), which both show great variation in surface markings, ranging through light and dark forms, several of which have been named by W. H. Edwards and others. While some of these forms appear to show geographical limitations, intermediate examples are

frequent and they fall into an obvious cline. It is probable that climatic factors are important in producing the various forms, with the paler phenotypes occurring in hot and dry localities, especially in Arizona. In addition other forms occur in Central Mexico and in Panama with very stable and distinct facies, which by the genitalia should be associated with one or other of the two widely distributed species. In each case these forms (*cynisca* (Godman and Salvin) and *ezra* (Hewitson)) appear with a restricted distribution, and it seems that in their areas they replace the more common forms.

(1) *Thessalia leanira*. (C. and R. Felder)

On upper surface ground colour cream-white, with fasciae of light and dark brown across both wings, of varying extent; pale discal fascia across hind wings, complete series of submarginal dots or macules present on both wings. On under surface submarginal dots also present, usually enclosed by darker scales, latter also outlining each nervure in characteristic fashion.

Neuration : in fore wings (fig. 86) nervure 6 arising from base of 7, cell almost completely closed by long disco-cellular nervure. This arrangement variable and in some cases, especially in female, nervure 6 separated from 7 by a recognisable upper disco-cellular nervure. In hind wing a vestigial lower disco-cellular nervure appearing in some examples (fig. 87).

Male genitalia (fig. 88) *:* tegumen wide and saccus slightly produced with shallow notch; long, slender terminal process of clasp directed horizontally across to overlap its fellow on opposite side; rather small penis (fig. 89) with a pointed apex and straight shaft, suspensory membrane placed at junction of middle and distal thirds.

Female genitalia (fig. 90) : with usual bifid bacillus, auricular notches narrow.

Palpi (fig. 91) slightly ascending, terminal segment about half as long as middle segment.

Five principal colour forms of this variable butterfly have been named, and these are described below. Very dark examples occur most regularly in the northern districts of the distribution area. In hot and dry desert conditions there appear paler forms in which the dark areas are replaced by fulvous or yellowish-grey. These probably represent ecological modifications induced by an exceptional environment, and should not be classed as subspecies. The butterfly occurs here and there in colonies in California, Arizona, New Mexico and Texas, and rather specialised melanic forms appear in Mexico, but the distribution area does not extend into the countries further south. Comstock says it is a species of the lowlands, not ascending far into the mountains, and that it is found from the St. Joacim Valley northwards through the entire State of California.

The species is well-represented in the B.M. (N.H.). In long series the named forms from *leanira* to *alma* grade into one another, and I have the impression of a continuous series with variation in one principal cline from the very dark forms of California to the extreme *alma* in which there are not any dark scales on the upper surface. On the under surface of the palest forms the fore wings look almost bleached, with the macules dead-white, and on the hind wings the dark pattern is mostly obsolete, but I have not seen any specimen in which some dark scales were not present to outline the nervures. Barnes and McDunnough (1913, *Contrib. Lep. N. Amer.* **2** : 4) suggested dividing the forms into two series depending upon the presence or absence of the dark basal markings on the under surface of the hind wing. To me this seems a very artificial way of dividing a continuous series, since these basal marks show every degree of development from the strong fascia of nominate *leanira* to complete absence in most forms of *alma*.

(*a*) form *leanira* (C. and R. Felder)

Melitaea leanira C. and R. Felder, 1860, *Wien. ent. Mschr.* **4** : 106. Loc. California.

Figures : C. and R. Felder, *Reise Novara* **3** : Pl. 50, figs. 13, 14.
Wright, Pl. 20, fig. 187*b*, *c*.
Comstock, Pl. 37, figs. 17, 18, 19.
Holland, *Ed.* **2**: Pl. 59, figs. 9, 10.

Expanse : ♂ 33–35 mm., ♀ 36–40 mm.

On upper surface in both sexes wings dark brown, ground colour appearing only as small macules ; some reddish scales present at base and apex of fore wings, as a rule some red marginal lunules, best marked in male specimens and lacking on hind wings. On under surface ground colour of fore wings orange-red with pale markings as on upper surface, outlined here and there with darker scales ; sub-basal fascia of dark macules on under surface of hind wings running from costa across cell and extending to inner margin at nervure 2. In most cases female larger than male and red flush on upper surface often less noticeable.

This is the nominate form, which is represented in the collection from the following localities.—California : San Francisco ; Mendocino Co. ; Winchester ; Siskyou Co. (May) ; Hamilton (June 1st) ; many specimens, " California " only.

Gunder (1930, *Bull. S. Calif. Acad. Sci.* **29** : 61) suggests that nominate *leanira* probably does not occur south of San Francisco.

(*b*) form *wrightii* (W. H. Edwards)

Melitaea wrightii W. H. Edwards, 1886, *Canad. Ent.* **18** : 64. Loc. San Bernardino, California.
Type : Carnegie Museum, Pittsburgh.

Figures : Wright, Pl. 20, fig. 188*b*, *c*.
Comstock, Pl. 38, figs. 2, 3, 4.
Holland, Pl. 17, figs. 9, 10 (type).
Seitz, Pl. 88*f*.

Expanse : ♂ 30–34 mm., ♀ 35–40 mm.

This form is close to nominate *leanira*, but it is slightly smaller and on the upper surface there is more extensive reddish scaling and the pale macules are a little larger. This is especially obvious in the complete series of red marginal lunules along the outer borders of both wings. All grades of transition occur between *wrightii* and typical *leanira*, with which the original specimens were flying. In this form the dark basal fascia on the under surface of the hind wing is less complete than it is in nominate *leanira*, and in some specimens it is almost obsolete.

Biology (Comstock and Dammers, 1932, *Bull. S. Calif. Acad Sci.* **31** : 9).—The larva is black with small orange macules between the black and shining dorsal spines, and again in a series above the stigmata. The pupa is silvery white with numerous black macules and bars (figures). The food-plant is *Castelleia* spp. (Scrophulariaceae). Observations in Mint Canyon.

Localities.—California : Mint Canyon (a long series, April) ; San Bernardino.

(*c*) form *cyneas* (Godman and Salvin)

Melitaea cyneas Godman and Salvin, 1878, *Proc. zool. Soc. Lond.* **1878** : 269. Loc. Oaxaca, Mexico.
Holotype : B.M. (N.H.).

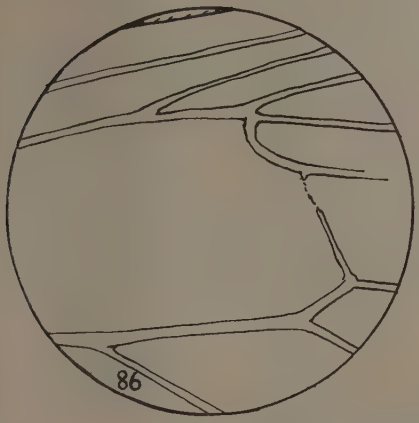
Figures : B.C.A., Pl. 21, figs. 10, 11.
Wright, Pl. 20, figs. 185, 186.
Holland, *Ed.* 2 : Pl. 58, fig. 30.

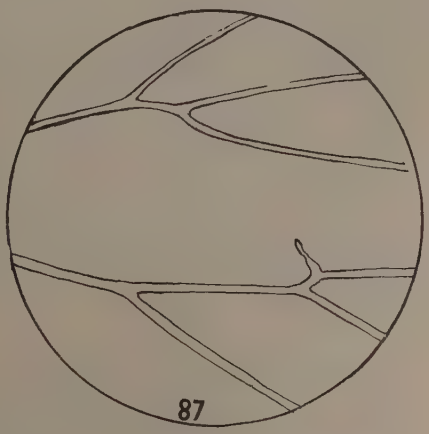
Expanse : ♂ 32–36 mm., ♀ 35–41 mm.

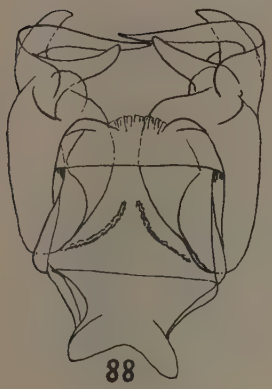
Moderate size. On upper surface wings widely suffused with rather dark brown, pale markings small, but appearance less dark than in nominate form ; series of submarginal dots complete, reddish marginal lunules well developed on both wings. On under surface of hind wings little or no trace of dark macules near base which are present in nominate *leanira*.

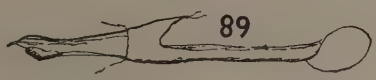
This form, about midway between typical *leanira* and the pale *alma*, has a wide distribution, and transitional specimens to *alma*, with rather larger pale markings, appear in Arizona and have been recorded by Brown (1957) from South Western Colorado. It is represented in the B.M. (N.H.) from the following localities.—Arizona :

Chisicahua Mts.; Conchise Co.; " S. Arizona ". MEXICO: Durango City; Pinal Puebla, 8000 feet; Guadalajara; Chihuahua; Pinos Altos; many specimens " Mexico " without full data.









FIGS. 86–91.—*Thessalia leanira :* (86) fore wing, neuration of disco-cellular area; (87) hind wing, the same; (88) male genitalia, dorsal view; (89) penis, lateral view; (90) female genitalia; (91) palpus.

(*d*) form *alma* (Strecker)

Melitaea alma Strecker, 1878, *Lepidoptera* Part 15 : 135. Loc. Arizona and Southern Utah.
Type : Chicago Natural History Museum.
Melitaea fulvia W. H. Edwards, 1879, *Trans. Amer. ent. Soc.* 3 : 191. Loc. Texas.
Type : Carnegie Museum, Pittsburgh.
Melitaea cerrita Wright, 1905, 161. Loc. Southern California.
Type : not traced.

Figures : Strecker, *loc. cit.*, Pl. 15, fig. 1 (*alma*).
Wright, Pl. 20, fig. 189 (*cerrita*).
Holland, *Ed.* 2: Pl. 59, fig. 6 (*fulvia*).

Expanse : ♂ 28–32 mm., ♀ 36–40 mm.

On upper surface dark tones replaced entirely by yellowish-brown, with pale markings outlined here and there by a few dark scales. On under surface of hind wings nervures dark and in most examples submarginal macules clearly marked, but dark sub-basal macules not present.

Distribution.—These pale forms appear in semi-desert areas in the south-western States. They are represented in the B.M. (N.H.) from the following localities.—California : Coso Valley (May) ; Argus Mts. (April). Arizona : Benson ; " Southern Arizona ". Texas : Brewster Co. ; " S.W. Texas ". New Mexico : Fort Nugane(?) —June.

Slight colour differences appear in the individual series from these various localities.

Biology (Comstock, Grace and Sperry, 1933, *Bull. S. Calif. Acad. Sci.* **32** : 102, figures.) —The larva (of *fulvia*) is described from observations at Oracle, Arizona. There is a close resemblance to *wrightii*, with the orange macules rather larger and an orange mark on the head. The pupa is not distinguishable from that of *wrightii*. Food-plant *Castelleia lanata*.

(*e*) form *cynisca* (Godman and Salvin)

Phyciodes cynisca Godman and Salvin, 1882, *Biol. Cent. Amer.* **1** : 191. Loc. Orizaba and Jalapa, Mexico.

Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 21, fig. 12.
Seitz, Pl. 88*h*.

Expanse : ♂ 34 mm., ♀ not seen.

Melanic form of average size, wing markings not conforming to type of variation appearing in standard cline. On upper surface of fore wings ground colour dark brown with white markings ; macule at extremity of discoidal cell of fore wing less oblique than in nominate *leanira* ; usual reddish marginal lunules entirely absent from both wings ; on hind wing a wide discal fascia of pale yellow, which includes yellow disco-cellular macule, base of the wing dark and unmarked. On under surface usual bright brown colour in cell and at outer margin of fore wing ; on hind wing small submarginal dots stand in a rather wide dark fascia, no dark macules at base of wing. Markings of specimens very uniform ; no female specimen seen.

Male genitalia (1 specimen) resemble those of nominate form.

Locality.—Mexico. The male holotype and 5 male paratypes in the collection are all from Orizaba and Jalapa, part of the original series collected for Godman and Salvin. The correct taxonomic rank of this form is uncertain.

(*f*) Named occasional forms

(*i*) *pelona*. *Melitaea wrightii* form *pelona* Gunder, 1930, *Bull. S. Calif. Acad. Sci.* **29** (figure). On the under surface of the hind wings the submarginal band is solid black and the dark nervures are emphasised. Loc. Mint Canyon.

(ii) *sinefasciata*. *Melitaea fulvia sinefasciata* Williams, 1914, *Ent. News* **25** : 265. Loc. Jamez Mts., New Mexico. A female in which the submarginal band is absent from the under surface of the hind wings.

(iii) *infrequens*. *Melitaea cynaeas* form *infrequens* Gunder, 1928, *Canad. Ent.* **60** : 166 (figures). Loc. Huachuca Mts., Arizona. A melanic specimen similar to *wrightii* form *carolynae* Gunder.

(iv) *carolynae*. *Melitaea wrightii* form *carolynae* Gunder, 1926, *Ent. News* **37** : 3 (figure). Loc. Mint Canyon, California. A melanic male specimen.

(v) *obsoleta*. *Melitaea leanira obsoleta* Edwards, 1877, *Proc. Calif. Acad. nat. Sci.* **7** : 171. Loc. California. A recurrent phenotype in which the dark submarginal band is absent from the under surface of the hind wings. (vide *sinefasciata* Williams). Replaces the type at San Rafael, Marin Co.

(vi) *leona*. *Melitaea leanira* ab. *leona* Wright, 1905 : 160, figure. The distal half of the submarginal band on the under surface of the hind wings is not developed.

(vii) *daviesi*. *Melitaea leanira daviesi* Wind, 1947, *Pan-Pacif. Ent.* **23** : 171. Loc. Tuolumne Co., California. Described as intermediate between nominate *leanira* and *wrightii*. Taken at 5500 feet altitude. Probably very near *wrightii*. *Holotype* : Calif. Acad. Sci.

(viii) *koebeli*. *Lemonias alma koebeli* Gunder, 1927, *Ent. News* **38** : 136 (figure). This form lacks the dark submarginal fasciae on the under surface of both wings. Loc. Inyo Mts., Argus Co., California.

(2) *Thessalia theona* (Ménétriés)

This well known species occurs more or less commonly from Southern California, Texas and Arizona southwards through the isthmus to Venezuela and Colombia. Although relatively constant in any given locality the butterfly shows great local variation and a confusing series of phenotypes has appeared, showing on the upper surface simple modification of colour from pale yellow-brown (*thekla*) to specimens in which the ground colour is almost black. The pale macules also vary in colour and disposition. There is a tendency in some areas towards suppression of the dark markings and enlargement of the discal macules which may become greatly elongated (*chinatiensis*, *perlula*).

In parts of Costa Rica and in Panama and on the islands along the Pacific coast, nominate *theona* disappears and its place is taken by the form *ezra* (Hewitson), a constant phenotype with very distinct facies, and sometimes considered specifically distinct. On the other hand the male and female genitalia appear indistinguishable from those of *theona*, and the forms are so closely related that I believe a more accurate picture is given if *ezra* is treated as a subspecies which has developed, for some reason, within the specific distribution area. In this way *ezra* falls into line with the other remarkable variants which appear in *Chlosyne* in the same district of Central America. In Venezuela and Colombia nominate *theona* appears again, but usually in forms transitional to *perlula* (C. and R. Felder), in which the dark markings on the upper surface of the hind wings become obsolete. To judge from the poor material available in the B.M. (N.H.), the species must be uncommon in the most southern districts of its distribution and the form *perlula* fully developed is clearly rare and local. Among this confusing array of local forms I think that *thekla* is best placed as an ecological modification appearing in hot and dry localities as it clearly falls into the general cline of variation. The forms with extended discal macules which occur with intermediates probably represent a different cline of general variation, and since their taxonomic status is uncertain I have placed them simply as " forms ". The phenotype *ezra*, which falls quite outside the standard cline, is dealt with as a subspecies.

(*a*) form *theona* (Ménétriés)

Melitaea theona Ménétriés, 1855, *Enum. Corp. Animal.* **1** : 86. Loc. Nicaragua.

Figures : Ménétriés, *loc. cit.*, Pl. 2, fig. 5.
Seitz, Pl. 89*g*.
Holland, *Ed.* 2, Pl. 59, fig. 5.

Expanse : ♂ 28–34 mm., ♀ 37–45 mm.

In male on upper surface ground colour some shade of brown ; rather large white or yellow macules in cell of fore wing and a prominent fascia of macules, commonly some shade of yellow, across post-discal areas of both wings ; series of darker orange-red macules present in submarginal area of hind wing. On under surface pattern on hind wing very striking, with gleaming white ground colour crossed by wide discal and submarginal bands of orange, nervures indicated in black.

Neuration (fig. 92*a*) : in fore wing nervure 6 arises very close to stalk of 7–10.

Male genitalia (fig. 92) : in dorsal view thickened terminal process of clasp turned across to meet its fellow from opposite side ; limbs of saccus wide-spread ; penis (fig. 93) pointed with ample ostium folds.

Female genitalia (fig. 94) show an oval sterigma with ostium exposed ; double bacillus not strongly chitinised.

Palpi (fig. 95) long and slender, scarcely ascending.

The early stages have not been described.

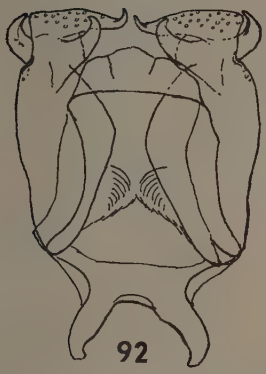
Localities.—Texas : without full data, with *thekla* and intermediates. Mexico : common in many places, especially in Northern Sonora. Nicaragua : Matagalpa ; Campalpa. Guatemala : common in many districts ; Polochic Valley ; Ysabal ; Chicam ; Vera Paz. Salvador : Ilopango ; Apopa. Honduras : San Pedro Sula. British Honduras : a series of small but typical specimens. Costa Rica : Avangarez ; others transitional to *perlula* Felder.

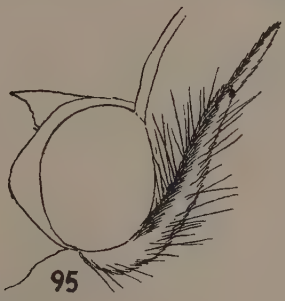
(*b*) form *thekla* (W. H. Edwards)

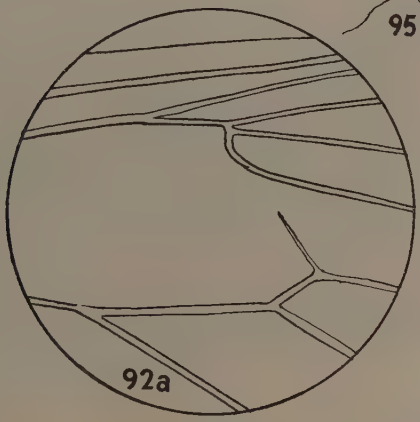
Melitaea thekla W. H. Edwards, 1870, *Trans. Amer. ent. Soc.* **3** : 191. Loc. Southern California.
Holotype : lost *fide* Barnes and McDunnough.
Melitaea bolli W. H. Edwards, 1877, *Field & Forest* **3** : 101. Loc. Texas (San Antonia).
Holotype : Philadelphia.
Figures : Holland, Pl. 17, figs. 15, 16.
Ed. 2 : Pl. 59, fig. 7.
fig. 8 (*bolli*) (♀).
Wright, Pl. 20, figs. 192, 193 (very pale).
Barnes and McDunnough, *Contrib. Lep. N. Amer.* **3** : Pl. 10, fig. 5, fig. 6 (transit.).

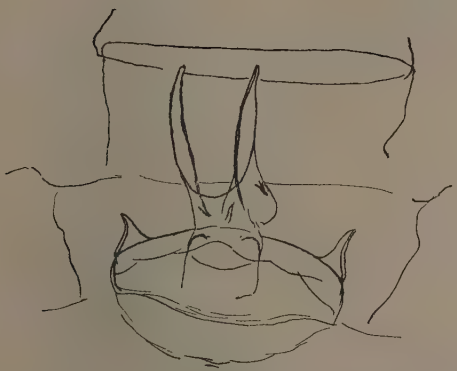
Expanse : ♂ 30–40 mm., ♀ 36–45 mm.

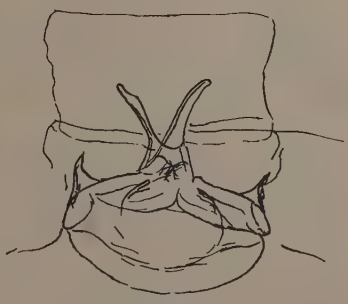
In hot and dry localities there is progressive reduction in the extent of the black fasciae and striae on the upper surface and the orange-red macules become paler, with loss of colour contrast. In particular the dark discal fascia and the heavy marginal and basal shading are replaced by orange-yellow. These paler forms, named *thekla* by Edwards, occur over a wide area, and especially in the South-Western States of North America where the species seems to be common and widely distributed. The form *thekla* appears as a stage in a cline which shows all grades of variation to typical *theona*. Although in many localities only *thekla* forms occur, the overall picture appears to me to suggest an ecological modification, and I think the appearance of true geographical variation is misleading and in consequence there is little indication of subspecific status. According to Hall *thekla* forms often occur with typical specimens and they are very common around Fort Grant in Arizona and in Northern Sonora. Specimens in the B.M. (N.H.) from Texas are very variable, with *thekla* forms and typical specimens of *theona* both represented.











FIGS. 92–95.—*Thessalia theona :* (92) male genitalia, dorsal view ; (92*a*) fore wing, neuration of disco-cellular area ; (93) penis, lateral view ; (94) female genitalia ; (94*a*) *ezra*. female genitalia ; (95) palpus.

Biology (of *bolli*). (Comstock, Grace and Sperry, 1933, *Bull. S. Calif. Acad. Sci.* **32** : 99.)—Observations at Oracle, Arizona. The mature larva is dark brownish-black, covered with small white dots except down the dorsum. There is a wide dull-yellow lateral stripe, enclosing the black spiracles. The spines are shining jet-black. The pupa is white with black longitudinal stripes. The food plant is *Castelleia lanata* Gray. Figures are given of the larva and pupa. Pupal stage May 19th–May 28th.

Localities.—Arizona : Fort Grant ; Benson. California : Sacremento Mts. ; Alamo Gordo. Texas : without precise data ; a variable series. Mexico : North Sonora, without further data ; a most variable series.

(*c*) form (?) *chinatiensis* (Tinkham)

Melitaea chinatiensis E. R. Tinkham, 1944, *Canad. Ent.* **76** : 12. Loc. Texas, Chinati Mts.
Holotype : not traced.

Figure : Tinkham, *loc. cit.* : 13 (♂ and ♀).

Expanse : ♂ 36 mm., ♀ 38 mm.

I do not know this insect in nature, and merely record the reference to the description and figures of E. R. Tinkham ; to me it appears to be a variant of *theona* near *thekla*. Pale macules on both wings extended as elongated streaks from discal to marginal areas, usual darker submarginal markings suppressed. On under surface of hind wings usual orange median fascia reduced to a few marks closing the cell. Some features of resemblance to southern *perlula* (Felder).

This rather large form is recorded only from the Chinati Mountains, a desert range in Presidio County, Texas. Three males and five females were taken in June and September, 1929, all at an altitude of about 4500 feet. Also taken by Stallings and Turner (1947, *Ent. News* **58** : 36) at Terlingua and Toyahvale, Texas, both at altitudes of 3800 feet.

Tinkham records that typical *theona thekla* was flying on the same mountain and at the same time as *chinatiensis*, but at a higher altitude, *i.e.* in Upper Sonoran life zone.

(*d*) form *perlula* (C. and R. Felder)

Eresia perlula C. and R. Felder, 1861, *Wien. ent. Mschr.* **5** : 104. Loc. Venezuela.
Holotype : not traced.
Phycicdes hondana Weymer, 1890, *in* Reiss and Stubel : *Reisen in Sud-Amerika* : 119.
Loc. Colombia ; Honda, Popayan.
Holotype : not traced.

Figures : Weymer, *loc. cit.*, Pl. 3, fig. 5.
Seitz, Pl. 89*g*.

Expanse : ♂ 33–38 mm., ♀ 40–46 mm.

In this form markings further modified by obliteration of all dark macules at base of hind wing which is uniform yellow, submarginal macules of same colour as are post-discal macules on fore wing. Many examples rather large compared with typical *theona*.

This form appears only in the southern area of distribution, where it replaces entirely more typical specimens, but intermediate examples occur in Costa Rica and in Venezuela. There are few specimens for comparison in the British Museum (N.H.) and Weymer records only seven examples from Colombia. These were taken at altitudes that varied from 200 m. to 2500 m. It seems likely that *perlula* should be placed as a subspecies, but at present data are scarcely sufficient to decide upon the correct status.

Localities.—Colombia : Chocoral ; San Jose ; Frentino. Venezuela : Merida ; San Sebastian ; San Esteban ; Onaca, *etc.* All examples from Venezuela are darker than those from Colombia.

(*e*) *theona ezra* (Hewitson)

Eresia ezra Hewitson, 1864, *Exot. Butt.* **3** : Eresia IV. No Locality.
Holotype : B.M. (N.H.).
Eresia yorita Reakirt, 1865, *Proc. ent. Soc. Philad.* **5** : 224. Loc. Honduras.
Type : Chicago N.H. Mus.

Figures : Hewitson, *loc. cit.*, Pl. 4, fig. 29.
Seitz, Pl. 89*g*. (good figure).

Expanse : ♂ 32–36 mm., ♀ 38–42 mm.
On upper surface normal wing pattern entirely changed by extension and fusion of pale yellow macules on fore wing, orange marking disappearing ; on hind wings a wide yellow discal fascia, which includes the disco-cellular macule, external to this a wide border without usual series of orange macules. On under surface absence of all orange markings very striking.
Genitalia indistinguishable from those of typical *theona* in both sexes (female genitalia, fig. 94*a*)

The markings are very constant, in fact in the entire series of specimens in the collection there is not one that shows any notable variation. Apart from the wing pattern I am not able to find any distinctive characters that will separate this butterfly specifically from *theona*. The curious distribution area is compact and well established, with normal *theona* appearing both north and south of the districts occupied by *ezra*. I think it is best considered as a geographical subspecies, which has a restricted distribution and is most common on the small islands off the Pacific coast of Panama (Hall).

Localities.—Panama : Bugaba ; Veraguas ; Calobre ; Pedro Miguel (Dec.) ; Canal Zone ; Chiriqui ; Taboga Is. ; Palenka Is. ; Burica Is. ; Matachin, *etc.* Colombia : Cabaco Is. (Nov.) ; Cauca (1 male). Honduras : reported by Hall. Costa Rica : Port Limon (1 male).

(*f*) Other described form

benjamini. Gunder, 1928, *Canad. Ent.* **60** : 166, figure. A specimen which is heavily shaded with black on the upper surface. The submarginal macules are present.

5. **Texola** Higgins

Higgins, 1959, *Lepid. News* **12** : 161. Type-species : *Eresia elada* Hewitson.

Very small insects with elongated fore wings. On upper surface ground colour orange-yellow with a network of fine black markings, or grey (*coracara*) ; on under surface markings repeated with some lunules and macules filled with white, a narrow orange border along the outer margins of both wings.
Neuration : in fore wing a short upper disco-cellular nervure, lower disco-cellular nervure well developed ; cell of hind wing quite open.
Male genitalia small and fragile ; clasp shows 3 processes, the terminal process very slender and directed transversely to overlap its fellow ; straight and pointed penis suspended slightly behind mid-point.
Female genitalia (*elada* only) *:* the unusual formation is described below.
Palpi relatively long, scarcely ascending (porrect).

The two species *elada* and *coracara* are clearly closely allied. The male genitalia in each case show a similar structure and in spite of the different external appearance the wing markings agree in certain features, and especially in the presence of pale submarginal dots, yellow in *elada* and white in *coracara*, which form a complete series across the upper surface of both wings. I think the rare species *anomala*, with similar wing markings, can be included here with confidence. A similar series of white points appears also in *Thessalia leanira* (C. and R. Felder), and the male genitalia in this

species show surprising resemblance to those of *coracara*, both in the formation of the clasps and in the elongated saccus, suggesting that all these insects are closely allied.

(1) *Texola elada* (Hewitson)

Eresia elada Hewitson, 1868, *Exot. Butt.* **4** : Eresia, Pl. VII, figs. 54, 55. Loc. " Mexico ".
Holotype : B.M. (N.H.).
Melitaea callina Boisduval, 1869, *Ann. Soc. ent. Belg.* **12** : 54. Loc. Sonora, Mexico.
Holotype : Carnegie Mus., Pittsburgh.
Eresia socia C. and R. Felder, 1869, *Verh. zool.-bot. Ges. Wien* **19** : 470. No locality.
Holotype : not traced.
Phyciodes hepburni Godman and Salvin, 1901, B.C.A. **2** : 679. Loc. Chihuahua Mts., Mexico.
Holotype : B.M. (N.H.).

Figures : Hewitson, *loc. cit.*
Holland, Pl. 17, figs. 3, 4.
B.C.A., Pl. 21, figs. 6, 7 (*elada*).
Oberthur, *Lép. Comp.*, fig. 2185 (*callina*).
B.C.A., Pl. 108, figs. 15, 16 (*hepburni*).

Expanse : ♂ 22–27 mm., ♀ 25–32 mm.

Upper surface sandy orange with heavy dark fuscous markings. On fore wings clear orange postdiscal fascia, with four costal macules forming a prominent feature ; usual submarginal fascia reduced to small spots, and submarginal lunules obliterated by wide fuscous hind marginal border, except the single yellow macule in cellule 4. Hind wings also heavily marked with fuscous but show a wide and clear orange discal fascia, tapering in width towards inner margin. On under surface of hind wings large white marginal semi-lunar macules separated by narrow black lunules from the complete orange marginal border. Female slightly larger than male but markings similar.

Neuration (fig. 96) *:* upper disco-cellular nervure of fore wings placed somewhat obliquely and cell almost completely closed by lower disco-cellular nervure ; cell of hind wings completely open.

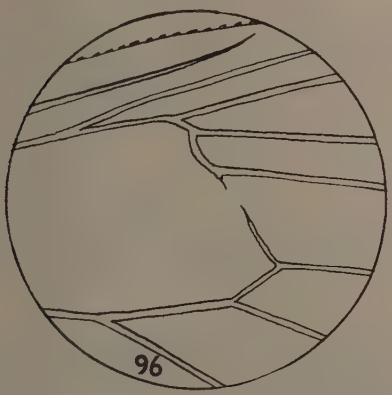
Male genitalia (fig. 97) show a wide simple tegumen with slight boss at each lateral angle ; clasp in lateral view (fig. 98) rather narrow with a strong tooth at posterior inferior angle ; harpe curved slightly forwards, extending horizontally, transversely ; slender terminal process also directed transversely and slightly backwards, appearing almost straight when viewed from above.

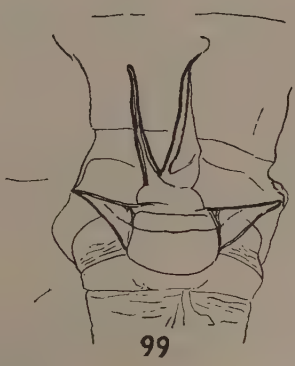
Female genitalia (fig. 99) (2 preparations) with well-developed bifid bacillus ; in other respects the structure is unusual. Auricles do not appear and sterigma not well defined posteriorly ; palpi (fig. 100) with somewhat dilated second segment and short slender terminal segment, the whole extended nearly horizontally forwards.

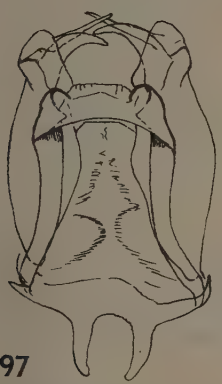
Biology.—I have not found a description of the early stages of this species.

Distribution.—Almost all examples of *elada* are from Mexico, where Hall records it as common locally in the south west, but not seen by him on the Atlantic slope. Hewitson's original figure is not good, but fortunately the holotype is still available in the B.M. (N.H.). *Phyciodes hepburni* Godman and Salvin shows *elada* with rather extreme fuscous shading on the upper surface, which I should judge to come within the normal range of variation. Boisduval's *callina*, illustrated by Oberthur, is not identical with nominate *elada* which it resembles in the broad wings, but on the upper surface the wings are less suffused with fuscous scales, the markings are more complete and the ground colour is paler. It is a female specimen, which may explain some of these features, and I think it is best considered as an intermediate form transitional to *ulrica* or *perse*, but still dark. There are similar specimens in London from various localities in Mexico. Barnes and McDunnough (1916, *Contrib. Lep. N. Amer.* **3** : 92) refer *callina* to *ulrica*, but it does not show the narrow wings and fiery uniform ground colour of this form. The holotype of *socia* C. and R. Felder is not to be found in the B.M. (N.H.) nor in the Rothschild collection, now incorporated. From the description I should think it is identical with *callina* or at least very close. In most districts this butterfly develops two annual generations. It is a variable insect, and of the

several forms described below each has its headquarters in a different State. Intermediate specimens occur and it is hard to decide whether the different forms should be regarded as true subspecies or whether the variation is predominantly ecological. In general the series available for study are taken from a few well-known localities in the very large area of specific distribution.







Figs. 96–102.—(96–100) *Texola elada :* (96) fore wing, neuration of disco-cellular area ; (97) male genitalia, dorsal view ; (98) clasp, lateral view ; (99) female genitalia ; (100) palpus. (101–2) *T. coracara :* (101) male genitalia, dorsal view ; (102) penis, lateral view.

It seems that the female specimen of *callina*, labelled " type " by Boisduval, was given by him to W. H. Edwards, and so did not find its way to Washington, with other American material from Oberthur's collection.

Localities.—Mexico : Jalisco ; Lake Xhapala ; Palmarito, 2300 feet ; Guerrero-Amula ; Iguala ; Venta de Zopilota, 2800 feet ; Tepetlapa ; Oaxaca ; River Balzar, 430 m. (June) ; Chilpanciungo ; Hacienda de la Imogen, 4000 feet. Arizona : Benson (very dark).

Specimens of the autumn generation from Guadelajara, Mexico are transitional to *perse* Edwards.

(*a*) *elada ulrica* (Edwards)

Melitaea ulrica W. H. Edwards, 1877, *Canad. Ent.* **9** : 189. Loc. San Antonio, Texas.
Type : Carnegie Museum, Pittsburgh.
Melitaea imitata Strecker, 1877 (recte 1878), *Lepidoptera* Part **14** : 130. Loc. Texas.
Type : Chicago Nat. Hist. Museum.
Melitaea senrabii Barnes, 1900, *Canad. Ent.* **32** : 43. Loc. Corpus Christi, Texas.
Type : not traced.

Figure : Holland, Pl. 17, fig 2 (type of *ulrica*).

Expanse : ♂ 21–24 mm., ♀ 25–28 mm.

In male fore wings narrow and pointed. On upper surface ground colour rather intense orange, more or less heavily marked with dark fuscous which may partly obscure pattern on fore wings ; orange discal fascia always clearly marked on hind wings. On under surface orange marginal border obvious on both wings, in spite of the small size.

Localities.—Texas : Brownsville (April) ; Bexar Co. ; Nueces River.

There are 4 males in the B.M. (N.H.) from the Fruhstorfer collection, all from Texas without precise data, which show marked approach to typical *elada*. The form *senrabii* Barnes is difficult to place with confidence, and I believe it has not been figured. From the description I would place it as a dark modification of *ulrica*. Tinkham (1944, *Canad. Ent.* **76** : 13) reports *ulrica* very common along rocky gullies in the Rio Grande Valley, Texas, in September. He suggests that *Baccharis glutinosa* may be a probable food-plant, but he did not find any larvae.

The single male example of *ulrica* at Pittsburgh in the Edwards collection is from San Antonio, Texas, and it has been marked by Edwards with his " type " superscription. It may be accepted as lectotype, and is figured by Holland.

(*b*) *elada perse* (Edwards)

Melitaea perse W. H. Edwards, 1882, *Papilio* **2** : 136. Loc. Fort Grant, Graham Mts., Arizona.
Type : Carnegie Museum, Pittsburgh.

Figures : B.C.A., Pl. 21, figs. 8, 9 (*imitata*).
Holland, Pl. 16, fig. 19.
Wright, fig. 196.
Seitz, Pl. 88*f*.

Expanse : ♂ 23–26 mm., ♀ 27–29 mm.

Slightly larger than nominate *ulrica* Edwards, but appearing smaller than *elada* because the wings are not so wide. On upper surface ground colour pale sandy yellow, with fine fuscous markings, very uniform over whole wings ; outer margin not especially dark, so that submarginal macules and marginal lunules are clearly developed on upper surface. Female larger, closely resembling male in colour and pattern.

Localities.—Arizona : Fort Grant (possibly paratypes from W. H. Edwards) ; Conchise Co. ; Pearce (May) ; Nogales. Mexico : North Sonora ; Durango City ; Magdelena.

Some specimens from Mexico are certainly transitional to *ulrica*. Examples of *dymas* are to be found in the collection from Nogales and Magdelena, with similar data to those of the *perse* specimens. It seems probable that the two species fly together in these localities.

There are two males and two females in the W. H. Edwards collection, each with Edwards' " type " superscription, and all from Arizona. No doubt these form part of the original series, and a lectotype requires specification.

(2) *Texola anomalus* (Godman and Salvin)

Phyciodes anomalus Godman and Salvin, 1897, *Trans. ent. Soc. Lond.* **1897** : 243. Loc. Colima, Mexico.
Melitaea anomala Rober, 1914, Seitz **5** : 433. Loc. Colima, Mexico.

Figure : B.C.A., Pl. 108, figs. 17, 18.

Expanse : ♂ 28 mm.

Few examples of this rare species are known. On upper surface fore wings very dark, with prominent post-discal white costal mark of four macules, quite similar in position to mark in *elada* ; on hind wings discal area yellow. On under surface of fore wings ground colour again very dark, and on hind wing discal fascia clearly marked, rather wider than it is in *elada*.

The original specimen figured by Godman and Salvin in B.C.A. came from the Staudinger collection. I have seen one other example in the collection at the American Museum, New York. I was able to compare this specimen with *coracara*, and it seems very obvious that they represent allied but different species. No example of this insect is available for dissection.

(3) *Texola coracara* (Dyar)

Phyciodes coracara Dyar, 1912, *Proc. U.S. Nat. Mus.* **42** : 40. Loc. Guerrero, Mexico.
Holotype : U.S. Nat. Museum, Washington.
Phyciodes albipunctata Rober, 1914, *Seitz* **5** : 444. Loc. Mexico.

Figure : Seitz, Pl. 90*f*.

Expanse : ♂ 26–30 mm., ♀ 29–33 mm.

Fore wing long, apex rounded and hind margin gently convex. On upper surface ground colour dark fuscous, with prominent post-discal costal bar of 4 white macules, external to this complete series of small white submarginal points commencing beneath costa and continuing across fore and hind wings. On under surface of hind wings a basal macule and 4 discal macules filled with dusky brown scales, as are marginal lunules, latter appearing also on fore wings. Fringes white, broadly interrupted with dark scales at nervures, giving appearance of an undulating border.

Neuration : very similar to *elada*, with a short upper disco-cellular nervure ; cell closed in fore wings, quite open in hind wings.

Male genitalia (fig. 101) *:* very small, shown drawn to same scale as figure of *elada*. Tegumen simple, long saccus an unusual feature ; clasp with long slender terminal process directed horizontally across to overlap its fellow ; penis (fig. 102) almost straight with a pointed apex. (The whole organ is so fragile and minute that I have not been able to make a successful drawing of the lateral view of the clasp.)

Locality.—Mexico. Hall records Iguala and Los Amates in Guerrero. He found it abundant in hot canyons in June and July at about 2500 feet. The original examples were from Sierra de Guerrero and Iguala at 2400 feet.

6. Dymasia gen. nov.

Very small butterflies, fore wings elongated, hind margin gently convex. Orange-yellow upper surface marked with irregular pattern of black network.

Neuration : in fore wing a short upper disco-cellular nervure ; in hind wing lower disco-cellular nervure developed.

Male genitalia short and wide, saccus deeply notched, terminal process sickle-shaped and directed backwards.

Female genitalia include an extensive and well-defined sterigma.

Palpi rather short, definitely ascending, with short terminal segment.

Male abdomen long, extending beyond anal angle of hind wings.

Type-species *Melitaea dymas* W. H. Edwards, 1877.

This genus is required for the single species *D. dymas* (W. H. Edwards). The resemblance in size and general appearance between this butterfly and *T. elada perse*

W. H. Edwards is not confirmed by closer examination, when the two insects are found to differ in nearly every anatomical character and in an important feature of wing pattern, in as much as *dymas* does not present the regular series of submarginal points which appears in *Texola*. These differences are so marked that I have found it impossible to write a generic synopsis to include both *dymas* and *elada*, and it seems best therefore to place the former in a different genus.

(1) *Dymasia dymas* (W. H. Edwards)

Melitaea dymas W. H. Edwards, 1877, *Canad. Ent.* **9** : 190. Loc. San Antonio, Texas.
Type : Carnegie Museum, Pittsburgh (1 ♀).
Melitaea chara W. H. Edwards, 1883, *Canad. Ent.* **15** : 209. Loc. Southern Arizona.
Type : Carnegie Museum, Pittsburgh.

Figures : B.C.A., Pl. 108, figs. 13, 14.
Wright, Pl. 20. fig. 195*a*, *b* (as *chara*).
Comstock, Pl. 37, figs. 14, 15, 16 (as *chara*).
Holland, Pl. 17, figs. 3, 4 (as *chara*).

Expanse : ♂ 24–28 mm., ♀ 29–30 mm.

On upper surface ground colour sandy-yellow, reticulated with black macules and striae ; on fore wings slight dusky scaling at apex and around outer margin, costal macule of postdiscal series usually pale, sometimes nearly white ; on hind wing markings regular with marginal lunules prominent in most forms, no broad discal fascia of ground colour as in *elada* Hewitson. On under surface of hind wing large white marginal lunules bordered externally by black marginal line showing traces of orange scales only in cellule 7. Amount of dark scaling on upper surface variable, and always less marked in female.

Neuration (fig. 103) : in fore wing upper disco-cellular nervure well developed, lower disco-cellular closing about half of cell ; in hind wing (fig. 104) a short lower disco-cellular nervure plainly visible closing lower half of cell.

Male genitalia (fig. 105) short and wide, with simple wide tegumen ; clasp (fig. 106) in lateral view oval, terminal process acicular and curved backwards in an arc to project beyond harpe when viewed from above ; penis (fig. 107) slender and pointed, with suspensory membrane rather behind mid-point.

Female genitalia (fig. 109) with oval, well-defined sterigma and usual bifid bacillus.

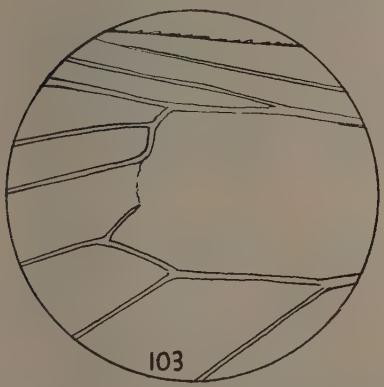
Palpi (fig. 108) ascending, terminal segment short and turned slightly downwards.

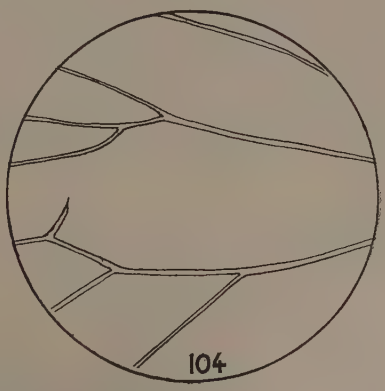
Biology (Comstock 1929, *Bull. S. Calif. Acad. Sci.* **28** : 50. Observations in October at Cottonwood Springs).—Egg shows only pits at the base, with ridges over the upper hemisphere. Mature larva grey, each short " colourless " spine from an orange basal macule. There is a wide white lateral stripe and other obscure black and white mottlings. The pupa is pale grey with some small dark spots. The imago emerged in 7 days. *Beleperone californica* is the food-plant. There are good figures of the egg and pupa. A figure of the larva is given in vol. **33** : 35, Pl. 15.

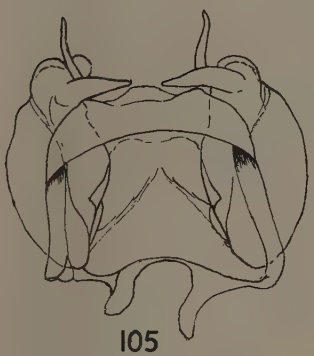
Distribution.—The data available suggest that this species is more at home in California than in Arizona or Mexico. Published descriptions and museum series do not show such striking variation as appears in the *elada* series, and I doubt whether it is possible to maintain *dymas* and *chara* as distinct local forms. While *dymas* is sometimes illustrated as a pale form, it seems that this is a conventional error, and the actual description was of a dark form, described as " brownish-black on the upper side, marked and spotted with orange-fulvous ". The darkest specimens in the B.M. (N.H.) are from Mexico. Good series in the Hall collection from Palm Springs show a tendency on the upper surface to increased dusky suffusion in the spring form and paler specimens in the summer brood, with less colour contrast. Bauer's recent introduction of the name *imperialis* (1958, *Lepid. News* **12** : 98) refers to the spring generation from Palm Springs. Distinction is made between the populations of California, Arizona and Texas, but the differences are not very well defined. Possibly a distinction becomes noticeable when long series are compared, when slight and inconstant

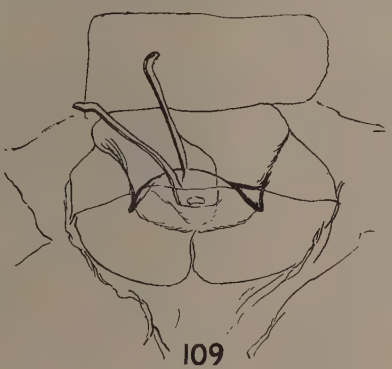
seasonal changes might become obvious. Hall remarked that subspecific divisions in this species were indefinite.

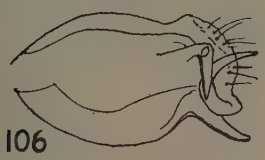
Localities.—California : Palm Springs (April and October) ; Los Angeles ; San Bernardino. Arizona : Tucson (May) ; Nogales ; several specimens simply " Arizona ". Mexico : North Sonora ; Magdelena.











Figs. 103–9.—*Dymasia dymas :* (103) fore wing, neuration of disco-cellular area ; (104) hind wing, the same ; (105) male genitalia, dorsal view ; (106) clasp, lateral view ; (107) penis, lateral, view ; (108) palpus ; (109) female genitalia.

Wright records this species from Utah and Nevada, and he figures an example from the " Colorado Desert ".

Note 1.—In the W. H. Edwards collection today there are 2 females of *dymas* labelled " Texas " and 1 female labelled " San Antonio, Texas ". All have the superscription " type " by Edwards. The single female from San Antonio should be

specified as lectotype. In the same collection the form *chara* is represented by a pair (male and female) from " Arizona Desert" and a second pair labelled " Arizona M." (=Morrison). All these bear the superscription " type " by Edwards, and a specification of lectotype is needed. One male from this series is figured by Holland (Pl. 17, figs 3, 4) which seems quite suitable for specification.

Note 2.—The date of publication of Strecker's name *larunda* appears from the cover of Part 14 of the " Lepidoptera " to be 1877, and W. H. Edwards published his name *dymas* in this year. However, Edwards has recorded in a note (*Papilio* **4** : 133) that this part did not in fact appear until March 1878, and his name *dymas* clearly has priority. I cannot discover that Strecker ever denied Edwards' statement, although he gives September 1877 as the date for *larunda* in his *Catalogue of Macrolepidoptera* (1878).

(*a*) form (?) *larunda* (Strecker)

Melitaea larunda Strecker, 1878, *Lepidoptera*, Part 14 : 130. Loc. S.W. Texas.
Type : Chicago Natural History Museum.

Figure : Holland, Pl. 16, fig. 18.

In the B.M. (N.H.) the only examples of this species from Texas consist of three males. These are rather exceptional, very pale on upper surface, normal black markings much reduced in intensity ; on fore wing usual pale postdiscal costal macule not developed, ground colour uniformly pale sandy-yellow.

The specimens do not agree with the description of *dymas* and it seems possible that they represent a pale local or seasonal form for which Strecker's name *larunda* would be appropriate. The original description emphasises that this is not a dark form. In the absence of adequate material from Texas it is not possible to make any further comment. There is not any published figure of the original male specimen still preserved in the Strecker collection at Chicago.

(*b*) Other described forms

(i) *jacintoi*. *Melitaea chara* male ab. *jacintoi* Gunder, 1924, *Ent. News* **35** : 157 (figure). Loc. Palm Springs, California. The pattern is partly obscured with abnormally placed dark suffusion.

(ii) *nitela*. *Melitaea chara* ab. *nitela* Comstock, 1926, *Bull. S. Calif. Acad. Sci.* **25** : 33. Loc. Palm Springs (April). *Type* : S.W. Museum. *Figure* : Comstock, Pl. 37, fig. 13. On the under surface the usual markings are partly suppressed.

7. **Microtia** Bates

Bates, H. W., 1864, *Ent. mon. Mag.* **1** : 83.
Type species : *M. elva* Bates.

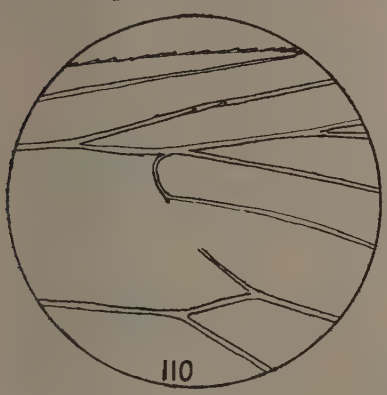
" Species of small size. Wings elongated, margins perfectly entire and rounded ; apex of fore wing obtuse ; abdominal margin of hind wings not forming a gutter to receive the abdomen, which latter extends beyond the extremity of the wings " (Bates, *loc. cit.*).

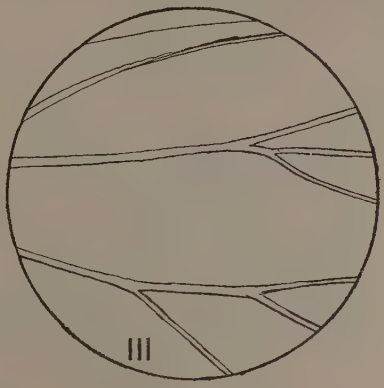
The genus was erected by Bates for *elva*, an insect which shows several divergent features and which remains the only member of the genus.

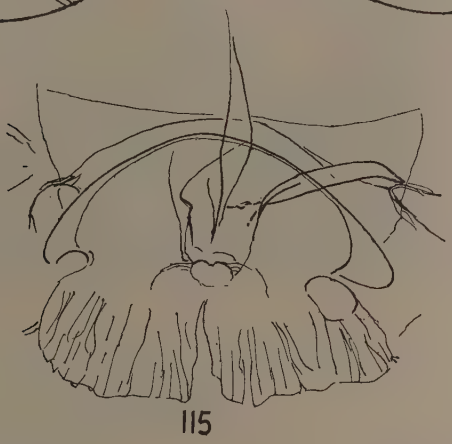
Neuration : in fore wing upper disco-cellular not developed, nervure 6 arising from base of 7 (fig. 110), lower disco-cellular closing about half cell. In hind wing cell quite open (fig. 111).

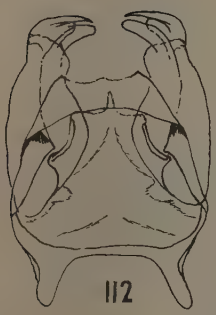
Male genitalia (fig. 112) : wide in dorsal view with a simple tegumen through which juxta can be seen to end in a low crest ; two limbs of saccus widely separated ; clasp with 3 processes directed medially, in lateral view (fig. 113) somewhat contracted posteriorly ; strong

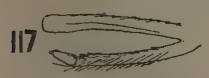
harpe, posterior inferior process arising just below it; apex of penis (fig. 114) pointed, with ample ostium-folds; distal limb rather short, with suspensory membrane at about two-fifths distance from apex.

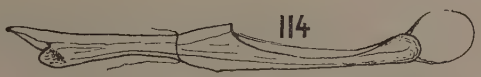












FIGS 110–17.—*Microtia elva :* (110) fore wing, neuration of disco-cellular area; (111) hind wing, the same; (112) male genitalia, dorsal view; (113) clasp, lateral view; (114) penis, lateral view; (115) female genitalia; (116) palpus; (117) male fore leg.

Female genitalia (fig. 115) : sterigma with definite anterior margin strongly convex; posteriorly extent of plate less definite. In the specimen examined ostium appears exposed. Double bacillus present, but the two limbs are not completely developed.

Palpi slender, width of middle segment exceptionally uniform; terminal segment directed slightly downwards (fig. 116).

Male fore leg (fig. 117) with tarsus greatly atrophied.

(1) *Microtia elva* Bates

Microtia elva Bates, 1864, *Ent. mon. Mag.* **1** : 83. Loc. Guatemala (interior).
Holotype : B.M. (N.H.).

Figures : B.C.A., Pl. 20, fig. 23.
Seitz, Pl. 88*h*.
Staudinger and Schatz, 1888, *Exot. Schmett.*, Pl. 36.

Expanse : ♂ 24–30 mm., ♀ 31–32 mm.

This little butterfly is too well-known to need description. In general appearance and habitus it is unique among its allies, and the unusual wing pattern suggests some mimetic association. There is some resemblance to several dark Erycynid species but it is not easy to suggest a possible model.

Distribution.—Mexico : Mezatlan ; San Blas (May) ; Jalisco (July) ; Ventanas (2000 feet, the apical orange stripe on the fore wings very narrow) ; Alamos ; Yucatan; Chichen Itze (markings yellow instead of orange) ; Ticul ; Valladolid ; Guerrero ; Amula (6000 feet), *etc.* Guatemala : Valley of Sta. Marina (Pacific slope) ; Central Valley ; Motagna ; San Geronimo (Vera Paz) ; Polochic Valley, *etc.* Salvador : Apopa. Nicaragua : Mata Galpa ; Chontales. Colombia : Manaure ; Sta. Marta ; Rio Magdelena-Baranquilla (July). Venezuela : " Venezuela " without further data. Costa Rica : " Costa Rica " without further data.

Colour forms show slight changes in the intensity of the black and orange fields and in the extent of the markings on both wings. At one extreme appear forms in which the colour is reduced and the post-discal orange bar on the fore wings is little more than a wide line. This is the case in the series from Ventanas (Mexico) and is illustrated by Staudinger and Schatz (*loc. cit.*). At the other extreme are forms in which the central orange fascia is extended, which may be referred to the form *horni* Rebel, described below.

(*a*) form *horni* Rebel

Microtia elva horni Rebel, 1906, *Verh. zool.-bot. Ges. Wien* **56** : 377. Loc. Oaxaca, Mexico.
Holotype : Vienna.
Microtia elva form *draudti* Rober, 1914, *Seitz* **5** : 455. Loc. Mexico.
Holotype : not traced.

Forms may be referred here in which the central orange fascia is extended to cover the basal half of the hind wing and of the fore wing, which is black only along the costa (*draudti*) or with the apical orange bar separated from the discal field by a narrow black line (*horni*). Both these forms are figured by Seitz on Plate 88*h*. Rebel's original specimens were taken at an altitude of 6000 feet. Material in the B.M. (N.H.) shows that the forms with extended orange markings are inconstant and often appear with more normal examples. In my opinion there is not any evidence that *horni* should rank as a subspecies.

Distribution.—Mexico : Coatepec ; Chiapas (June) ; Vera Cruz. Guatemala : Valley of Sta. Maria ; San Geronomi (with intermediates).

8. **Fulvia** Higgins

Higgins, 1959, *Lep. News* **12** : 162. Type species : *Melitaea fasciata* Hoppfer.

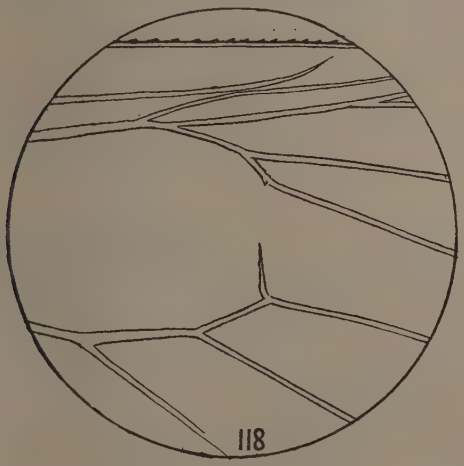
Small species, fore wing short and wide, apex not produced, posterior margin entire and slightly convex ; hind wings ample.

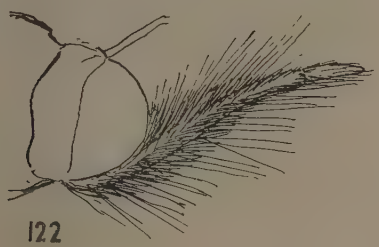
Neuration in fore wings unusual (fig. 118). Nervure 11 arises very close to stalk of 7–10 ; upper disco-cellular long and branches into 6 and 5 as oblique branches, in a similar pattern to that in *Gnathotriche* C. and R. Felder ; lower disco-cellular developed to close lower half of cell.

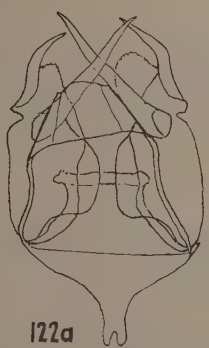
Male genitalia (fig. 119) with greatly elongated saccus ; tegumen narrow and conical ; oval clasps (fig. 120) terminate posteriorly in a long slender process, below which (in *fasciata*) appears the usual short, strong tooth ; penis (121) cylindrical (not flattened as in *Chlosyne*) with proximal and distal limbs of nearly equal length.

Male fore leg greatly atrophied, tibia clothed with long hair.

Palpi (fig. 122) characteristic, long, horizontal.







FIGS. 118–22*b*.—(118–22) *Fulvia fasciata :* (118) fore wing, neuration of disco-cellular area ; (119) male genitalia, dorsal view ; (120) clasp, lateral view ; (121) penis, lateral view ; (122) palpus. (122*a*, *b*) *Fulvia miriam :* (*a*) male genitalia, dorsal view ; (*b*) clasp, lateral view.

Since only male specimens are known there has not been any opportunity to examine the female genitalia.

This is a small and isolated group with many peculiar features. In shape and size *fasciata* Hoppfer recalls *proclea* Hewitson, but there is no anatomical evidence of close relationship.

(1) *Fulvia fasciata* (Hoppfer)

Melitaea fasciata Hoppfer, 1874, *Stett. ent. Z.* **35** : 349. Loc. Chanchamayo, Peru.
Holotype : destroyed during the war.
Eresia pearcei Druce, 1876, *Proc. zool. Soc. Lond.* **1876** : 222. Loc. Pozzuzu, Peru.
Holotype : B.M. (N.H.).
Phyciodes fasciatella Rober, 1914, Seitz **5** : 438. Loc. Huancabamba, Peru.
Holotype : lost or destroyed.

Figures : Druce, *loc. cit.*, Pl. 18, fig. 3 (*pearcei*).
Seitz, Pl. 89*f* (*fasciatella*).

Expanse : ♂ 23–25 mm., ♀ unknown.

Small species with short, wide wings, quite unlike any related species except *proclea* Hewitson. On upper surface ground colour dark brown, marked with several narrow fasciae of orange-yellow. On hind wing prominent yellow fascia behind disc. The anatomical features have been described in the generic synopsis.

Distribution.—The species appears to be confined to the mountains of northern Peru. It is represented in the B.M. (N.H.) from the following localities.—PERU : Chanchamayo ; Pozzuzu ; Huancabamba—3000–5000 feet ; Rio Pampacones : San Miguel 6000 feet ; Torontoy 7000 feet, *etc.*

The extensive series consists entirely of male specimens.

(2) *Fulvia miriam* (Dognin)

Phyciodes miriam Dognin, 1888, *Le Naturaliste* (2) **1** : 67. Loc. Ecuador, Loja.
Holotype : B.M. (N.H.).

Figure : Dognin, *Lep. de Loja* (2), Pl. 3, fig. 2.

Resembles *fasciata* Hopffer in size and general appearance, but on upper surface colour greyish-brown with rather indefinite markings, yellow fascia not appearing on hind wings.

Male genitalia (fig. 122*a*) very small and delicate, with simple and rather wide tegumen, and long slender harpe ; posterior inferior process best seen in lateral view of clasp (fig. 122*b*), appearing as a slender curved spine which extends beyond posterior extremity of clasp ; broad rounded lobe occupying position of usual terminal process ; small saccus with shallow terminal notch.

Female not known.

Locality.—Only known from Loja in Ecuador. There are seven male specimens in the collection and four specimens in the Hall collection, all part of Dognin's original material. It was stated that the butterflies were taken in the immediate environs of Loja, and probably at a relatively low altitude.

9. **Antillea** Higgins

Higgins, 1959, *Lepid. News* **12** : 164 (figures). Type species : *Papilio pelops* Drury.

Very small species, with short and wide fore wings, hind margin straight. On upper surface markings brown macules arranged in transverse fasciae upon darker ground colour.

Neuration : in fore wings nervures 5, 6 and stalk of 7–10 arise from a common point ; discoidal cell completely open (*pelops*) or with vestigial lower disco-cellular nervure (*proclea*). In male hind wing nervures 1*a* and 1*b* modified to accommodate between them a tuft of long hair scales.

Male genitalia : tegumen greatly modified and prolonged ; clasp oval, without any posterior process and with definite tooth arising posteriorly from inferior border. The very large penis is the outstanding feature, flattened from side to side, and terminating in a small and pointed ostium keel, almost like a beak. Structure of organs most unusual, details differing considerably in the two species. The complicated tegumen recalls *Phyciodes*.

Female genitalia (*proclea*) : relatively large and complicated sterigma, with short wide bacillus, two rods visible, short and not well defined. The characters are distinctive.

Palpi ascending and long, with short terminal segment.

This genus shows many features, including wing neuration, long tegumen, shape of the palpi and in particular the form of the female genitalia, which place it clearly with the *Phyciodes* section. It diverges in the presence of the tooth from the inferior margin of the clasp, which is not produced into a long posterior process. The whole structure of the organs is most unusual, quite unlike that of any other species, and it is difficult to guess the significance of such exceptional features, but the relationship with *Phyciodes* is clear. A single species (*Anthanassa frisia* Poey) of the latter section occurs within the distribution area of *Antillea*. The genus is of great interest on account of its isolation in the Greater Antilles ; it is not represented on the mainland of Central America.

A. pelops is the smallest Nymphaline butterfly.

(1) *Antillea pelops* (Drury)

Papilio pelops Drury, 1773, *Ill. Exot. Entom.* **1** : 38 and Index. Loc. St. Christopher Island.
Argynnis pygmea Godart, 1819, *Encyc. Méth.* **9** : 130. Loc. " America ".
Holotype : Edinburgh Museum.
Papilio aegon Fabricius, 1781, *Spec. Ins.* **2** : 130. Loc. Jamaica.
Erycina aedon Godart, 1823, *Encyc. Méth.* **9** : 587. *Nom nov.* pro *aegon* Fabricius, 1781, nec *Papilio aegon* Schiffermueller, 1775.
Melitaea anacoana Herrich-Schaeffer, 1844, *Corr. zool-miner. Ver. Regensb.* **1844** : 162.

Figures : Drury, *loc. cit.*, Pl. 19, figs. 3, 4 (recognisable).
Seitz, Pl. 89*f*.

Expanse : ♂ 18–22 mm., ♀ 18–24 mm.

On upper surface ground colour of both wings orange-brown, markings consisting of irregular brown transverse striae ; on under surface of hind wings some grey and violet shades.

Neuration : in fore wing (fig. 123) discoidal cell short, less than one-third total length of fore wing, lower discoidal nervure not developed. In hind wing (fig. 126) sexual male scale—pencil in body groove very noticable.

Male genitalia (fig. 127) with complicated tegumen indicating an approach to *Phyciodes*. Clasp in lateral view (fig. 128) oval with strongly curved harpe and notched tooth at posterior inferior angle. Very large penis (fig. 129, lateral view) provides an important generic character.

Antennal club (fig. 124) fusiform.

Palpi (fig. 125) show generic characters with short terminal segment.

Distribution.—The species is confined to the Greater Antilles, where it occurs on several islands.

Localities.—Cuba : Santiago (Feb.) ; Tanamo (Mar.) ; Holquin ; Rio Cano. St. Kitts : two males, no further data. Jamaica : Blue Mts. Porto Rico : Not represented. Hispaniola : " Haiti ", no further data.

Kaye (*Trans. ent. Soc. Lond.* **1925** : 466) says that this species is rare in Jamaica. Specimens from Haiti are slightly larger, as a rule, than those from other islands, and examples in the B.M. (N.H.) from Jamaica are smaller than any others. There is no obvious distinction in colour or markings between the series from the various islands. There are 12 male specimens from St. Kitts in the Hall collection.

(2) *Antillea proclea* (Doubleday and Hewitson)

Melitaea proclea Doubleday and Hewitson, 1847, *Gen. Diur. Lep.* : 181. Loc. Jamaica.
Holotype : B.M. (N.H.).

Figure : Doubleday and Hewitson, *loc. cit.* Pl. 23, fig. 4.

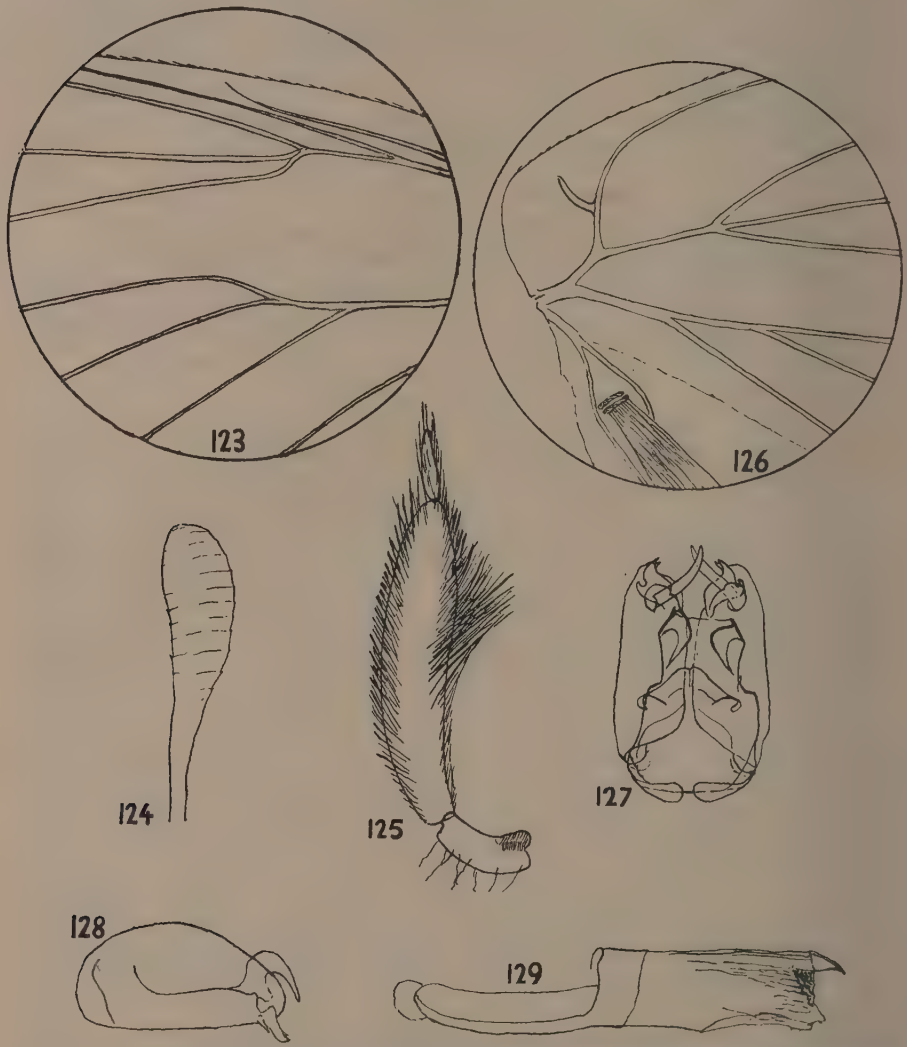
Expanse : ♂ 21–23 mm., ♀ 22–24 mm.

Slightly larger insect than *pelops*, with similar markings on upper surface of brown striae upon a fulvous ground colour. It may be distinguished without difficulty by small white point on upper surface of fore wings, placed near costa at darkened apex. On under surface of hind wing 5 small ocellated spots in submarginal area.

Neuration : in fore wing discoidal cell occupies nearly half total length of wing ; vestigial lower disco-cellular nervure present, at least in some individuals.

Female genitalia (fig. 130) have been described in generic synopsis

Male genitalia (fig. 131) with prolonged and slightly complicated tegumen ; saccus peculiar, the two lobes appearing to cross over one another ; oval clasp with short terminal process and



Figs. 123–9.—*Antillea pelops :* (123) fore wing, neuration of disco-cellular area ; (124) antenna, club ; (125) palpus ; (126) hind wing, neuration of disco-cellular area ; (127) male genitalial dorsal view ; (128) clasp, lateral view ; (129) penis, lateral view.

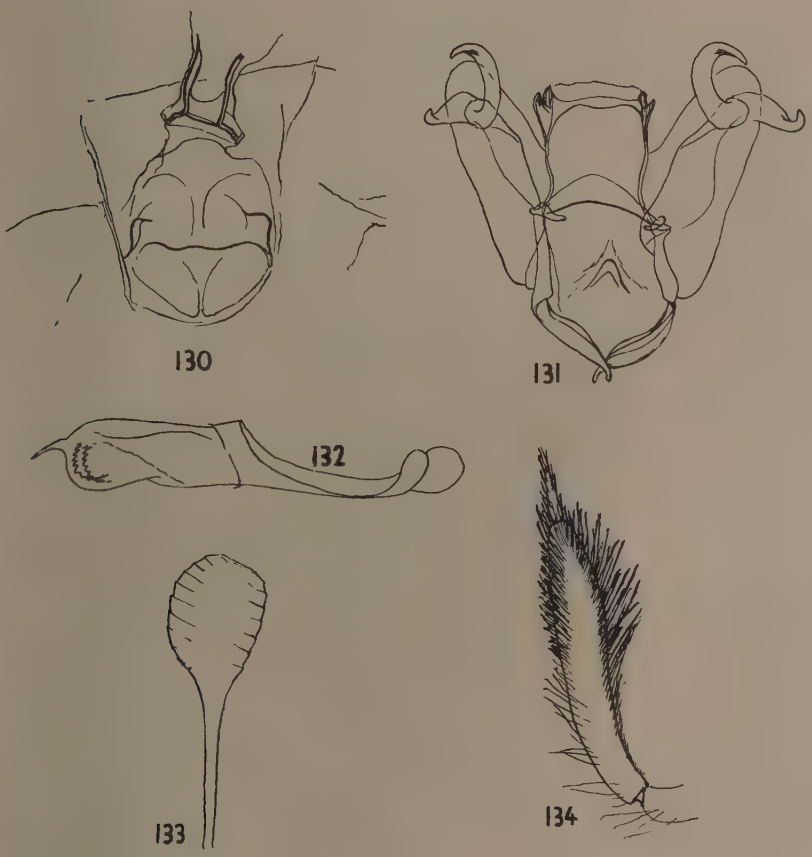
tooth at posterior inferior angle ; strong harpe curved outwards, extending beyond end of clasp ; penis very large, flat from side to side, with fine pointed ostium-keel (fig. 132). (It is difficult to make satisfactory preparations of such small and fragile organs.)

Palpi with generic feature of small terminal segment (fig. 134).

Antennal club (133) expanding abuptly.

Distribution.—The species is peculiar to Jamaica. Kaye (*loc. cit.*) reports it as common on the Blue Mountains, at altitudes of 100–2700 feet.

Localities.—Jamaica : Fish River ; Kingston ; Moore Town ; Portland ; St. Thomas, 100 feet (July).



Figs. 130–4.—*Antillea proclea :* (130) female genitalia ; (131) male genitalia, dorsal view ; (132) penis, lateral view ; (133) antennal club ; (134) palpus.

III. Summary

A taxonomic revision is presented of a group of 39 species of American Melitaeine butterflies, including the important genus *Chlosyne* Butler, 1870, with locality data taken from specimens in the collection at the British Museum (Natural History) and other collections. Reference is made to published figures which exist for nearly all the forms described. The structural anatomy of the series is illustrated by 134 line drawings to show neuration, male and female genitalia and other features.

Especial care has been taken to examine the original descriptions in all cases and to check references to the literature. Where information regarding the early stages has been published, reference to the original articles is given.

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